

Session 2, Part 2: Using Forecast Products to Generate an Air Quality Forecast

Various Internet Products and Tools to Help You Forecast

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Meteorological and Air Quality Elements

Use products that guide in the prediction of these elements

- Large-scale forcing
- Diurnal mixing
- Clouds, fog, precipitation
- Fronts
- Local winds
- Transport
- Carryover
- Special emissions

Products

Essential products

- Air quality monitoring data
- National Weather Service (NWS) forecast discussion
- 500 mb, 850 mb, and surface charts
- Soundings
- Meteograms and time/height cross-sections

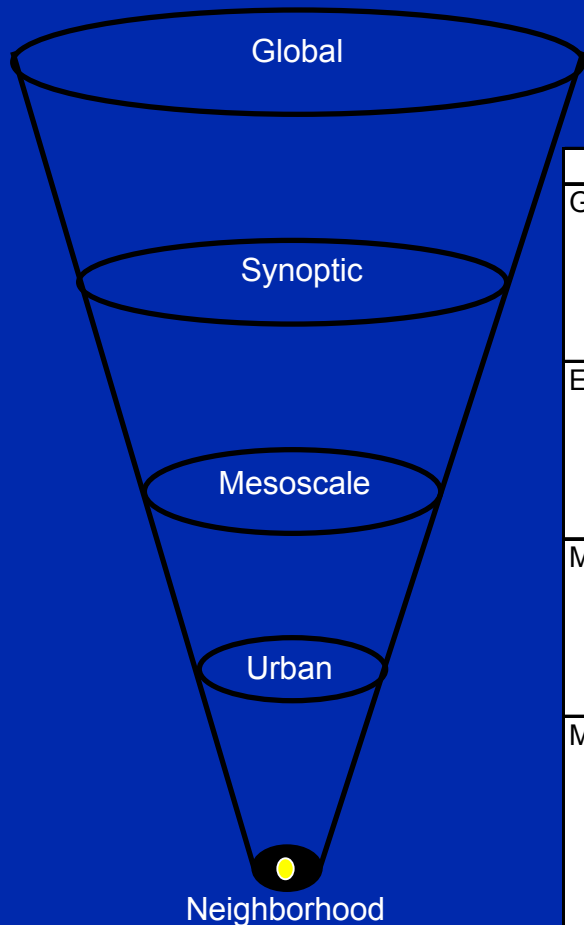
Useful products

- MOS and FOUS
- HYSPLIT
- Satellite imagery
- Forecast submittal

Products Under Development

- Web portal
- MODIS
- Photochemical models (operational in some areas)

Background – Weather Data and Predictions (1 of 3)



Overview of numerical models

Model	Use	Parameters	Scale	Time Period
GFS	Long range weather model good for detecting synoptic-scale changes. Coarse resolution (160 km)	Surface and aloft winds, height, temperatures, humidity, precipitation, etc.	Global and Synoptic	16 days
Eta	Weather model to predict changes in current and next day weather conditions. Finer resolution (12-40 km)	Surface and aloft winds, height, temperatures, humidity, precipitation, etc.	Synoptic and Meso	84 hours
MM5	Weather model to predict changes in current and next day weather conditions. Very fine resolution (4 km). Regionally tuned.	Surface and aloft winds, height, temperature, humidity, precipitation, etc.	Meso	84 hours
MOS	A set of statistical equations that use model output to forecast the probability of precipitation, high and low temperature, winds, cloud cover, and precipitation	Surface winds, temperatures, humidity, precipitation, clouds, visibility, etc.	Meso and Urban	8 days

Background – Weather Data and Predictions (2 of 3)

- Time format used in weather products

- GMT/UTC/Zulu

	PST	MST	CST	EST
Hours from UTC	-8	-7	-6	-5

- Example: 00Z Feb 2 = 1600 PST Feb 1

- Some observations in LST

- Forecast time periods

- Time valid

- Based from model initialization time (00 or 1200 UTC) + forecast periods 12, 24, 36, 48, 72, 96 hrs., etc.

- Example: 24-hr forecast from 1200 UTC model run is valid at 1200 UTC the next day.

- Forecast periods range from every 3 hours to every 12 hours

Background – Weather Data and Predictions (3 of 3)

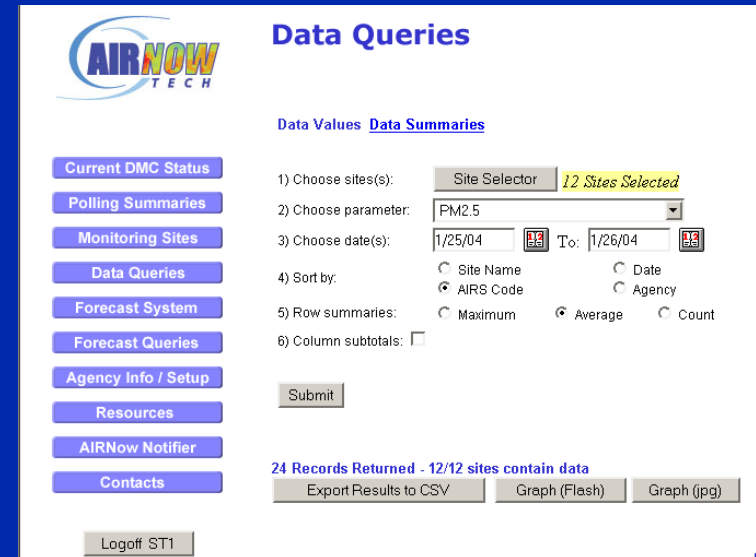
Observations

- Measured meteorological conditions
- Common types
 - Surface
 - Upper-air
- Frequency
 - Surface data are reported hourly (more frequently if warranted)
 - Upper-air balloons (rawinsondes) are launched twice a day (three times a day if there is a severe weather threat)
- Time
 - Surface observations are reported in local time
 - Upper-air rawinsonde data are reported in UTC

Air Quality Monitoring Network (1 of 2)

- Use for obtaining current trends and for predicting pollutant transport
- Links
 - State and local agencies
 - AIRNow: <http://www.epa.gov/airnow/index.html>
 - AIRNowTech: <http://www.airnowtech.org>
 - AIRNowForecaster: <http://www.airnowforecaster.org>

AIRNowTech – View and plot hourly data from any site

February 2003

NWS Forecast Discussion (1 of 2)

- Use the discussion to
 - Learn which features are dominant for the forecast period
 - Learn which model is performing best
 - Narrow down timing of features such as fronts or precipitation
- Links
 - <http://www.wrh.noaa.gov/wrhq/nwspage.html>
 - <http://iwin.nws.noaa.gov/iwin/iwdspg1.html>
 - <http://www.arl.noaa.gov/ready/cmet.html>
 - http://www.met.tamu.edu/personnel/students/weather/weather_interface.html

NWS Forecast Discussion (2 of 2)

The discussion is a detailed explanation of which factors are driving the NWS forecast for the next few days.

AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE DETROIT/PONTIAC MI
327 PM EST WED JAN 7 2004

.DISCUSSION...

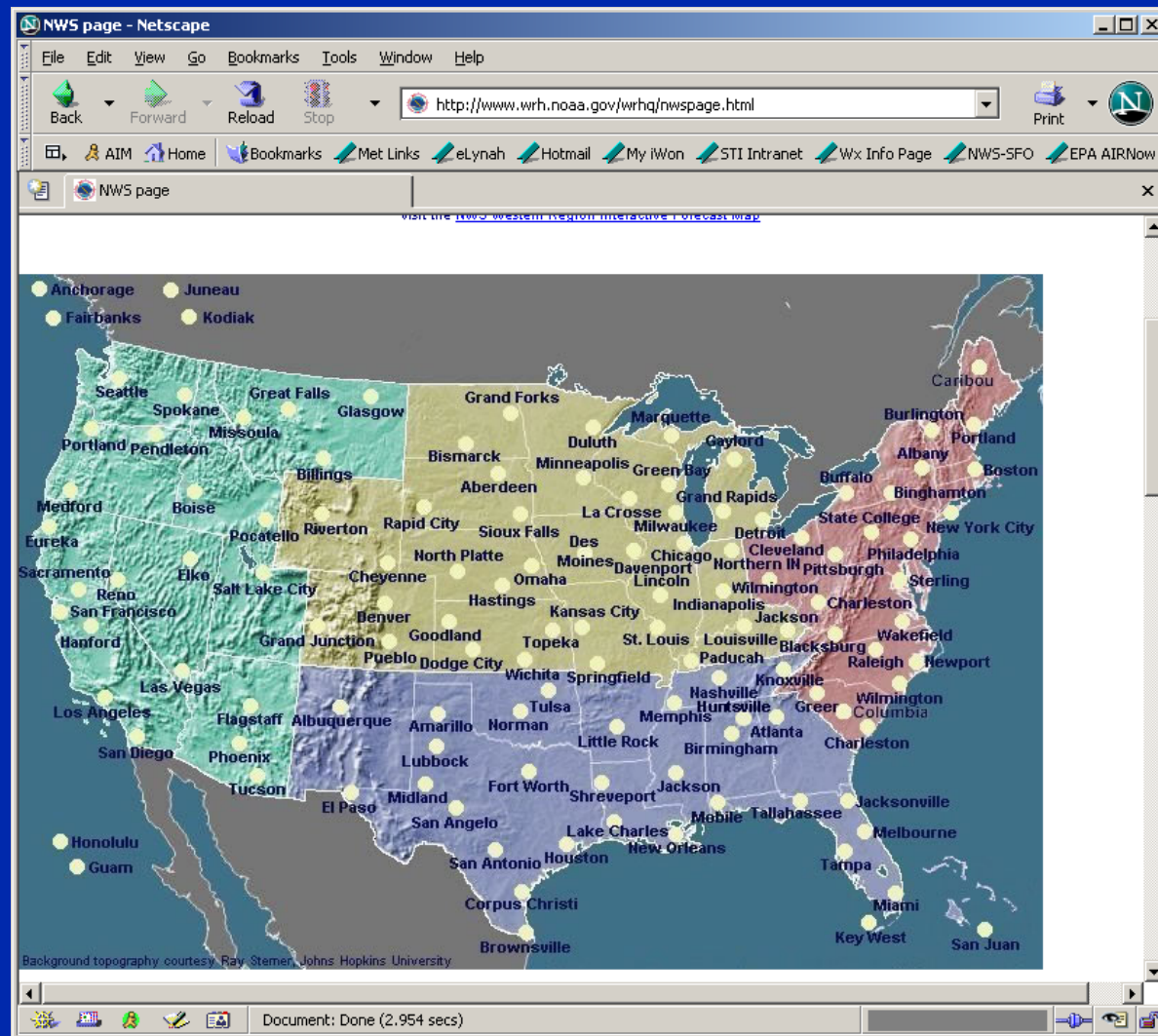
MODELS RATHER SIMILAR THROUGH THE SHORT TERM. AT 500 MB...SHORTWAVE TROUGH ENERGY COMING ACROSS NORTHERN ROCKIES INTO PLAINS TONIGHT AND TRACKING PRIMARILY SOUTH OF GREAT LAKES THURSDAY NIGHT INTO FRIDAY...THEN NORTHWEST FLOW SHARPENING BEHIND THIS FEATURE FRIDAY/SATURDAY AS EASTERN TROUGH AMPLIFIES. AT THE SURFACE...FLAT RIDGE OVER AREA TONIGHT...THEN BROAD TROUGH MOVING IN AS LOW CENTER DEVELOPS SOUTHEAST TO SOUTHERN IL THURSDAY NIGHT AND CONTINUES SOUTHEAST FRIDAY WITH STRONG CANADIAN HIGH BUILDING DOWN OVER AREA BY SATURDAY. NEW GFS VERY SIMILAR TO OVERNIGHT RUNS...LENDING SUPPORT TO GFS...ALSO SEE LATER PERIODS DISCUSSION.

850 TO 500 MB RELATIVE HUMIDITIES INCREASING THURSDAY AFTERNOON...SHRINKING SOMEWHAT THURSDAY NIGHT...THEN MODERATE AT BEST THEREAFTER THROUGH SATURDAY WITH GFS THE BEST MOISTURE. 925 MB MOISTURE MODEST TONIGHT...MODEST THURSDAY MAINLY IN AFTERNOON...THEN DECENT EVEN INTO SATURDAY DESPITE RIDGE BUILDING DOWN.

OMEGA LIFT LITTLE OR NONE IN LOW TO MID LEVELS UNTIL INCREASING MODESTLY THURSDAY INTO THURSDAY EVENING ESPECIALLY SOUTH...BEFORE SUBSIDENCE SETS IN THEREAFTER THROUGH SATURDAY. 850 TO 500 MB QVECTOR FORCING WEAK THURSDAY INTO THURSDAY EVENING MAINLY SOUTH...ALSO LIFT BOLSTERED THEN BY SLIGHT FRONTOGENETICAL FORCING. SURFACE CONVERGENCE MAINLY CONFINED TO LATE THURSDAY NIGHT THROUGH FRIDAY NIGHT CENTERED ON THUMB...THEN WEAKENING SATURDAY.

- Written 2 to 4 times a day by each NWS office
- Tuned for meteorologists
- Level of detail varies from office to office, and most recent discussions may only be brief updates
- Sometimes not very relevant to air quality (depending on NWS office)

NWS Offices



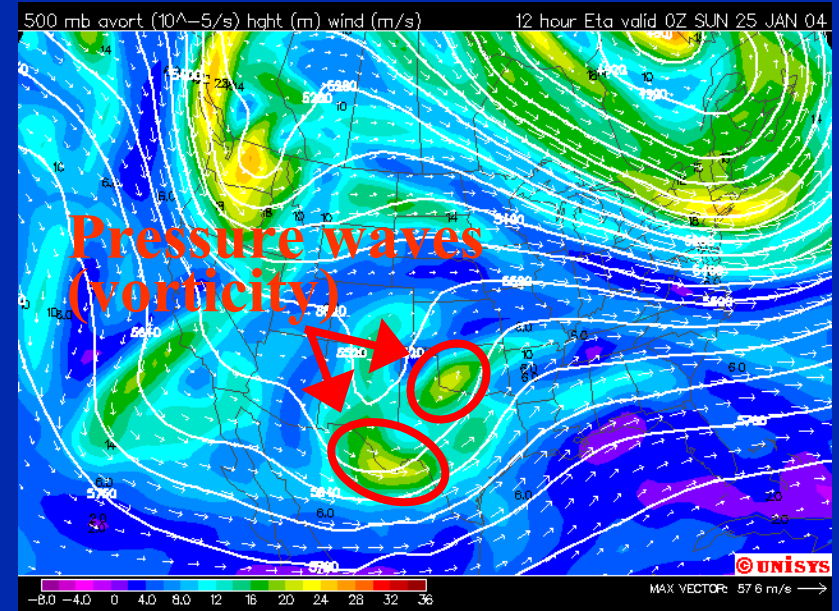
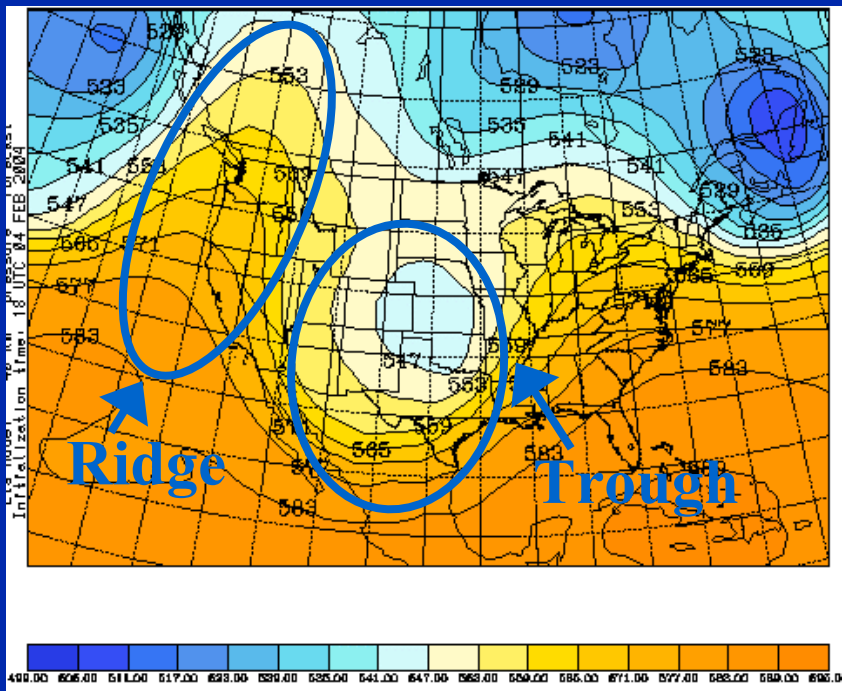
<http://www.wrh.noaa.gov/wrhq/nwspage.html>

500-mb Charts (1 of 3)

- Use these charts to identify aloft pressure patterns
 - Good idea of overall weather patterns
 - Can infer atmospheric stability and areas of rising and sinking motion
- What to look for
 - Large-scale troughs or ridges
 - Small-scale pressure waves
- Links
 - <http://weather.unisys.com/index.html>
 - http://ggweather.com/loops/ncep_loops.htm
 - <http://www.arl.noaa.gov/ready/cmet.html>
 - <http://weather.uwyo.edu/models/>
 - <http://www.rap.ucar.edu/weather/model/>

500-mb Charts (2 of 3)

Forecast weather conditions for the 500-mb pressure level, including height, wind, and small-scale pressure waves (identified by looking at vorticity).

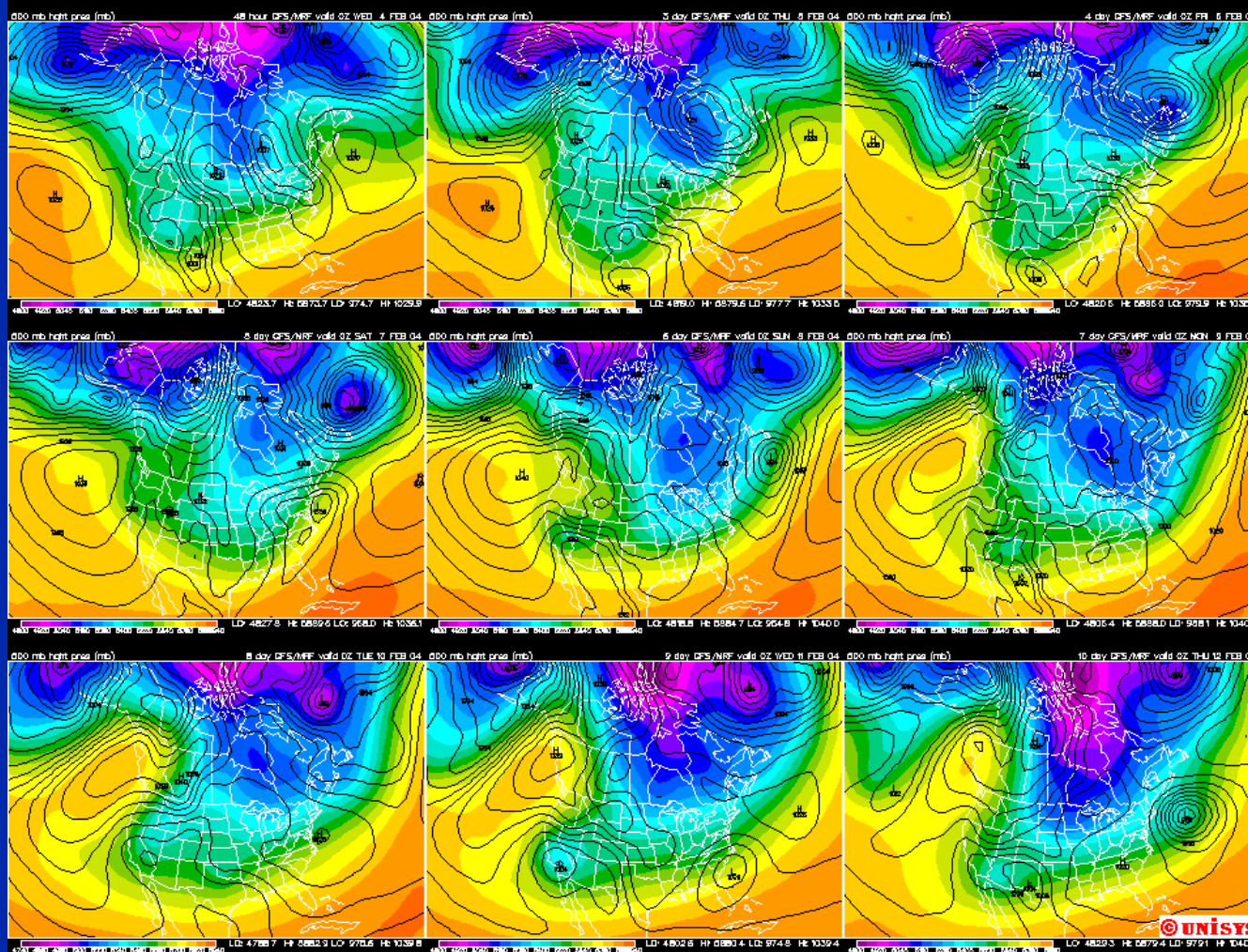


<http://weather.unisys.com/index.html>

<http://www.arl.noaa.gov/ready/cmet.html>

500-mb Charts (3 of 3)

500-mb heights plotted with sea-level pressure



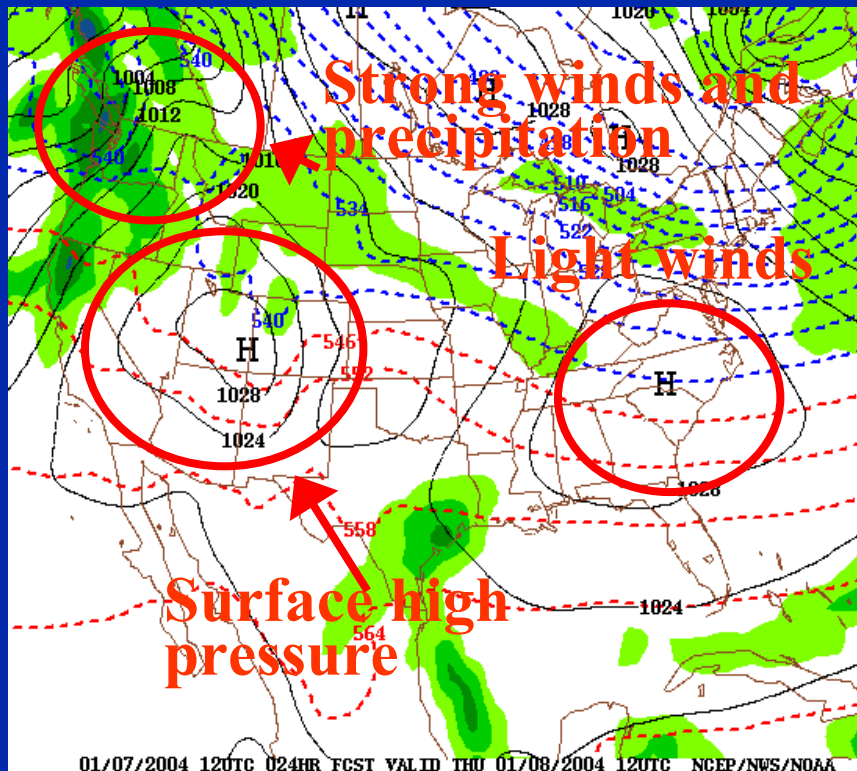
<http://weather.unisys.com/index.html>

Surface Charts (1 of 2)

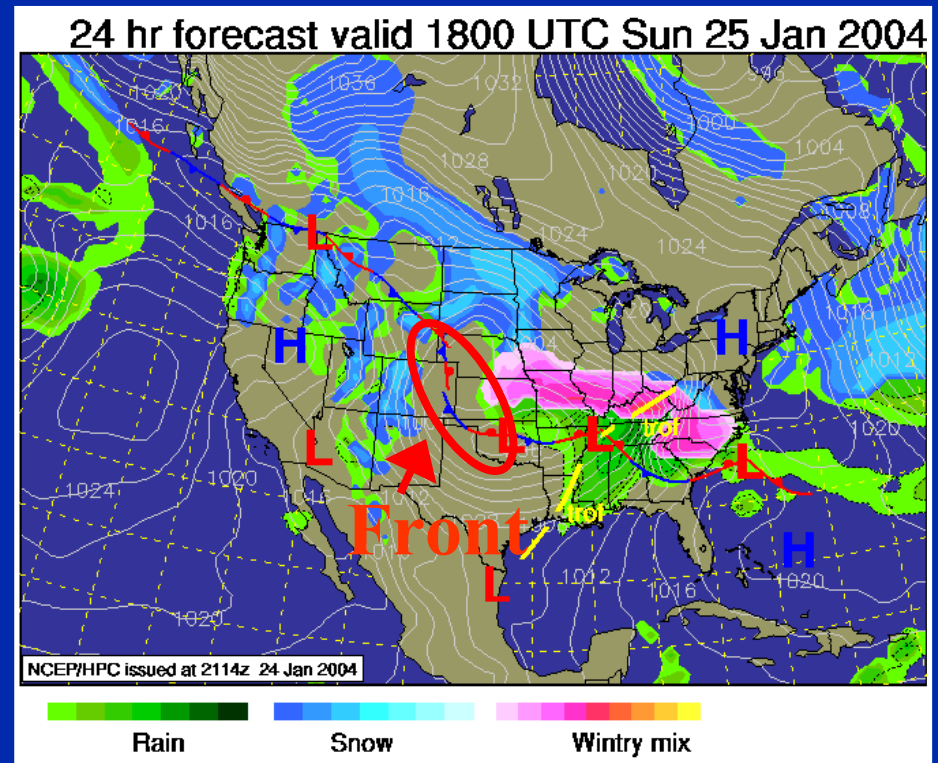
- Use these charts to identify large-scale patterns and precipitation, locate frontal boundaries, and determine surface wind speed and transport direction
- What to look for
 - High or low pressure
 - Frontal boundaries
 - Winds
 - Precipitation
- Links
 - <http://weather.unisys.com/index.html>
 - <http://www.arl.noaa.gov/ready/cmet.html>
 - http://ggweather.com/loops/ncep_loops.htm
 - <http://weather.uwyo.edu/models/>
 - <http://www.rap.ucar.edu/weather/model/>
 - <http://www.rap.ucar.edu/weather/progs/>

Surface Charts (2 of 2)

Forecast weather conditions for the surface including sea-level pressure, wind, and precipitation



http://qgweather.com/loops/ncp_loops.htm



<http://www.rap.ucar.edu/weather/progs/>

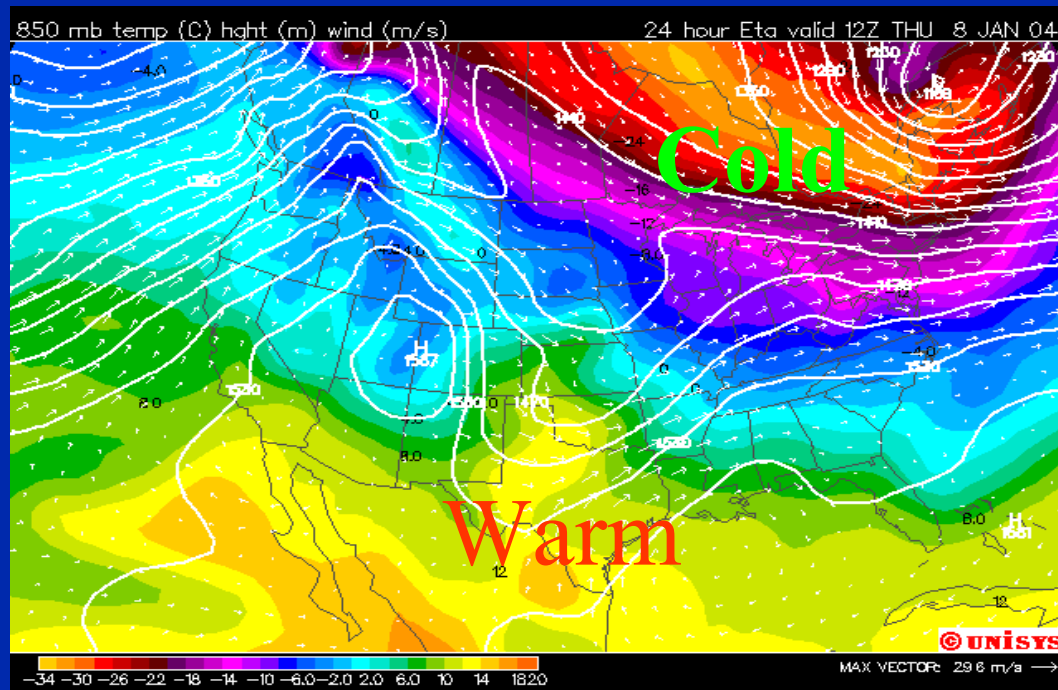
Precipitation is reported as Quantitative Precipitation Forecast (QPF) and is the summation of precipitation since the last forecast period; typically a six or twelve hour summation.

850-mb Charts (1 of 3)

- Use these charts to identify aloft temperature and winds.
 - Aloft temperatures are a good indicator of stability
 - Aloft winds are often key to pollutant transport
- What to look for:
 - Wind strength and direction
 - Aloft temperature (warm or cold, increasing or decreasing?)
- Links
 - <http://weather.unisys.com/index.html>
 - http://ggweather.com/loops/ncp_loops.htm
 - <http://www.arl.noaa.gov/ready/cmet.html>
 - <http://weather.uwyo.edu/models/>
 - <http://www.rap.ucar.edu/weather/model/>

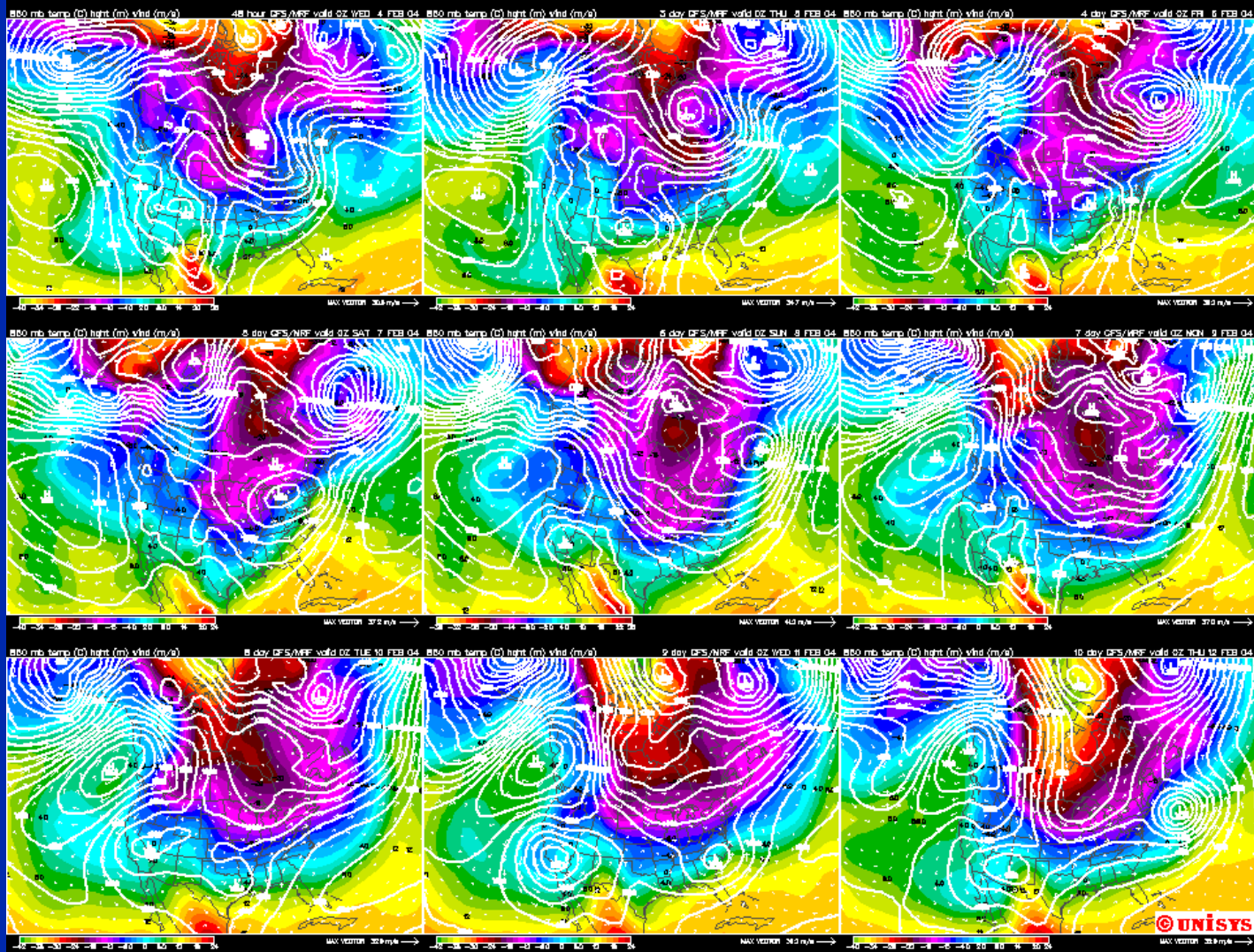
850-mb Charts (2 of 3)

Forecast weather conditions for the 850-mb pressure level, including height, wind, and temperature.



<http://weather.unisys.com/index.html>

850-mb Charts (3 of 3)



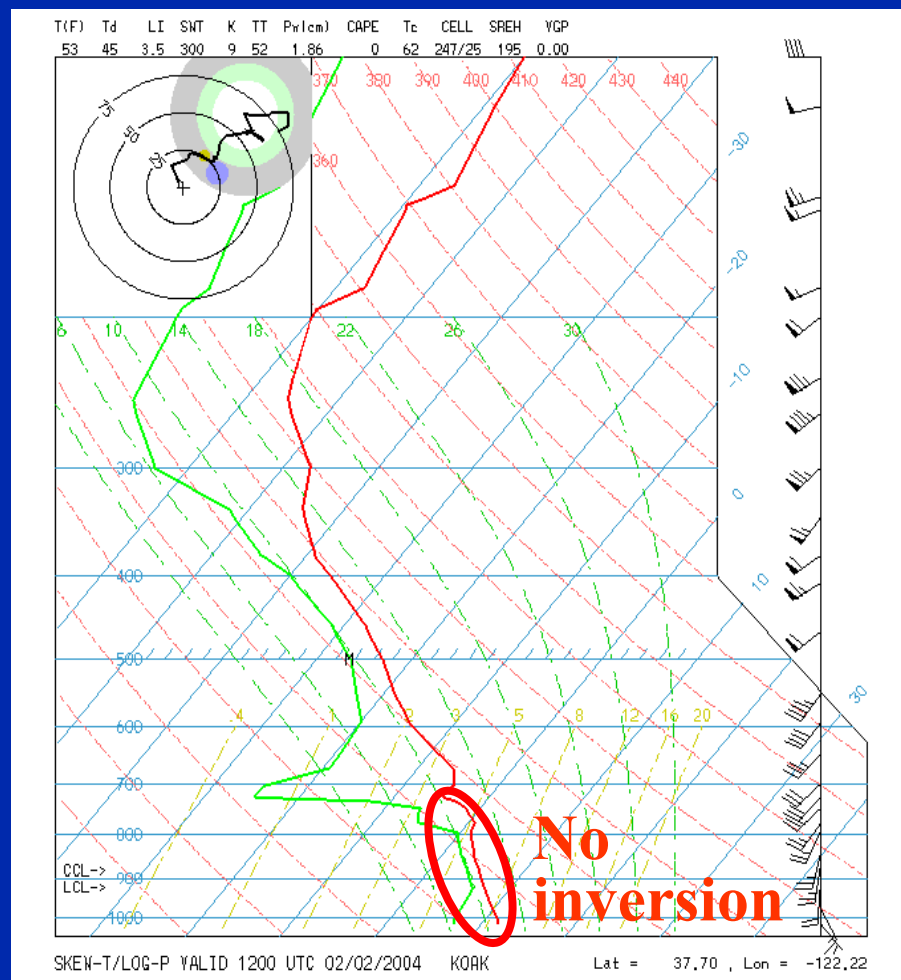
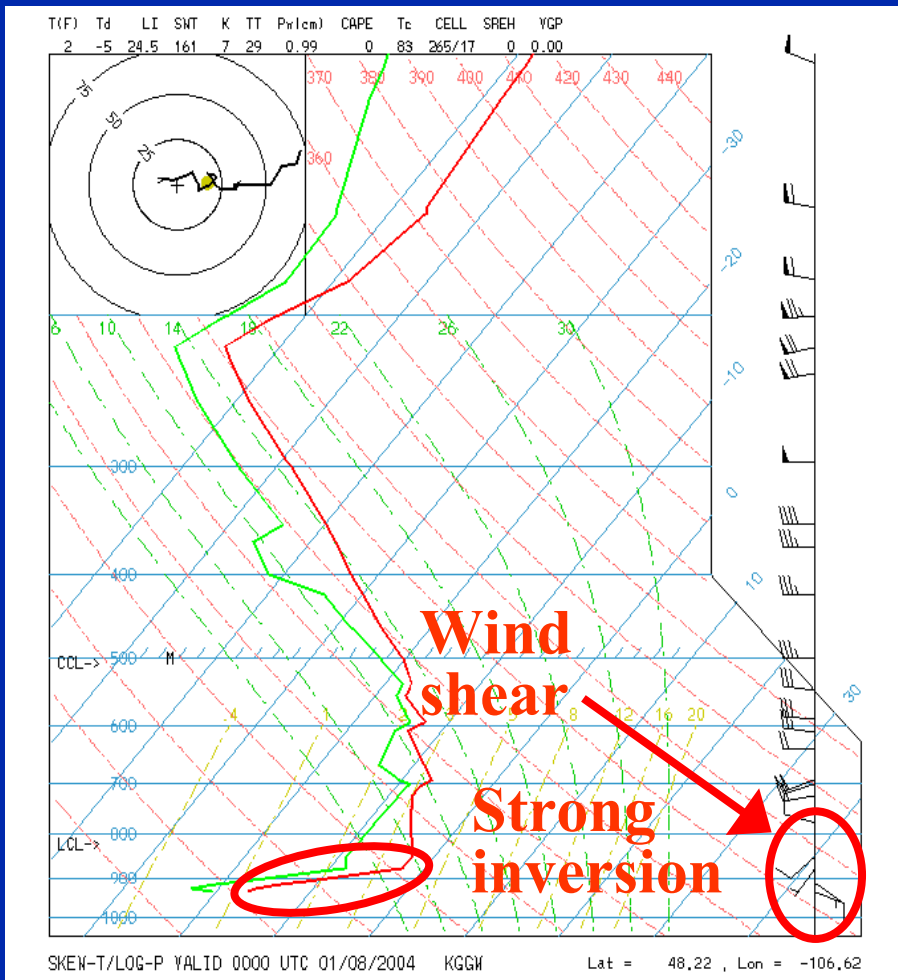
<http://weather.unisys.com/index.html>

Soundings (1 of 2)

- Use soundings to identify temperature inversions, stability, and winds
- What to look for
 - Temperature inversions
 - Mixing height
 - Wind shear
- Links – current
 - <http://www.rap.ucar.edu/weather/upper/>
 - <http://weather.uwyo.edu/upperair/sounding.html>
 - <http://vortex.plymouth.edu/uacalplt.html>
- Links – forecast
 - <http://www.emc.ncep.noaa.gov/mmb/etasoundings/snding.html>
 - <http://www.arl.noaa.gov/ready/cmet.html>
 - <http://cyclone.plymouth.edu/grbsnd.html>

Soundings (2 of 2)

Vertical profile of temperature, dew point temperature, and wind.



<http://www.rap.ucar.edu/weather/upper/>

Meteograms (1 of 3)

- Shows time series plots of observed and forecasted weather at a selected location
- What to look for
 - Wind shift
 - Precipitation
 - Temperature
 - Relative humidity
 - Pressure change
- Links – current
 - <http://weather.unisys.com/surface/meteogram/index.html>
 - <http://cyclone.plymouth.edu/statlog.html>
- Links – Forecast
 - <http://www.arl.noaa.gov/ready/cmet.html>
 - <http://wwwt.emc.ncep.noaa.gov/mmb/etameteograms/>
 - <http://www.arl.noaa.gov/ready/cmet.html>

Meteograms (2 of 3)

Time series of specific forecasted meteorological parameters, such as temperature, wind, rainfall

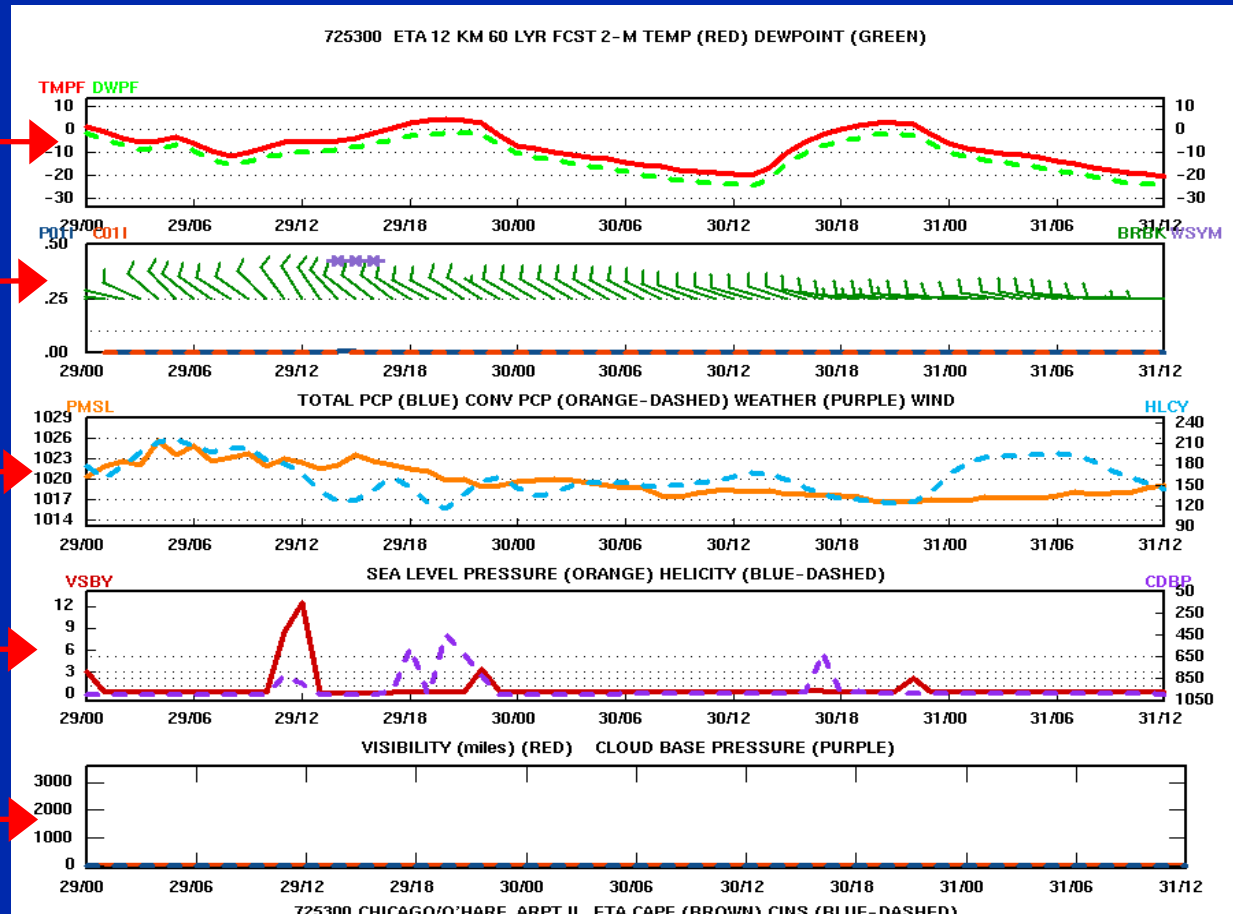
Temperature
/dew point

Wind and
precipitation

Sea-level
pressure
and helicity

Visibility and
cloud base level

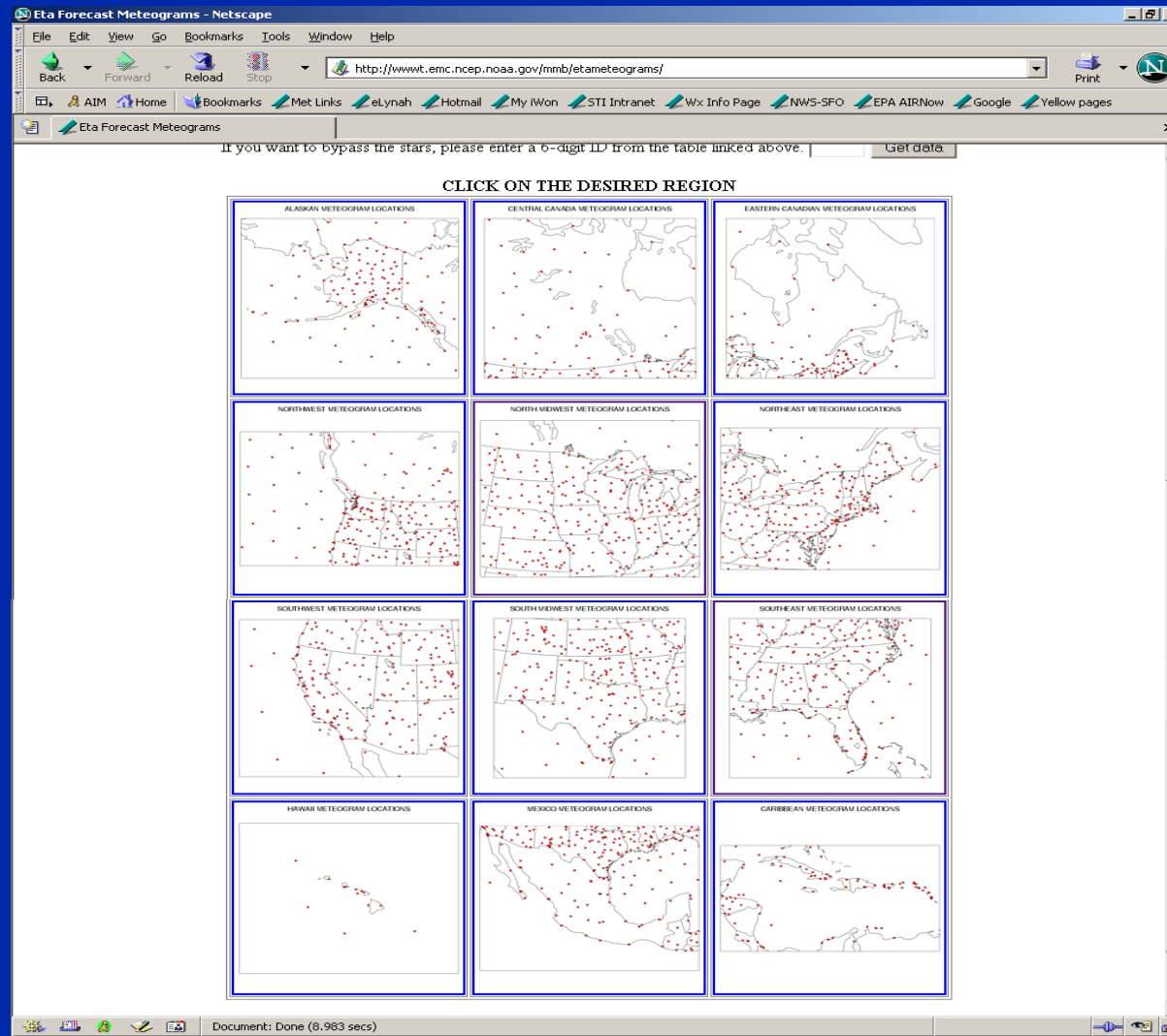
CAPE and CIN
(stability)



<http://wwwt.emc.ncep.noaa.gov/mmb/etameteograms/>

Meteograms (3 of 3)

Meteogram sites

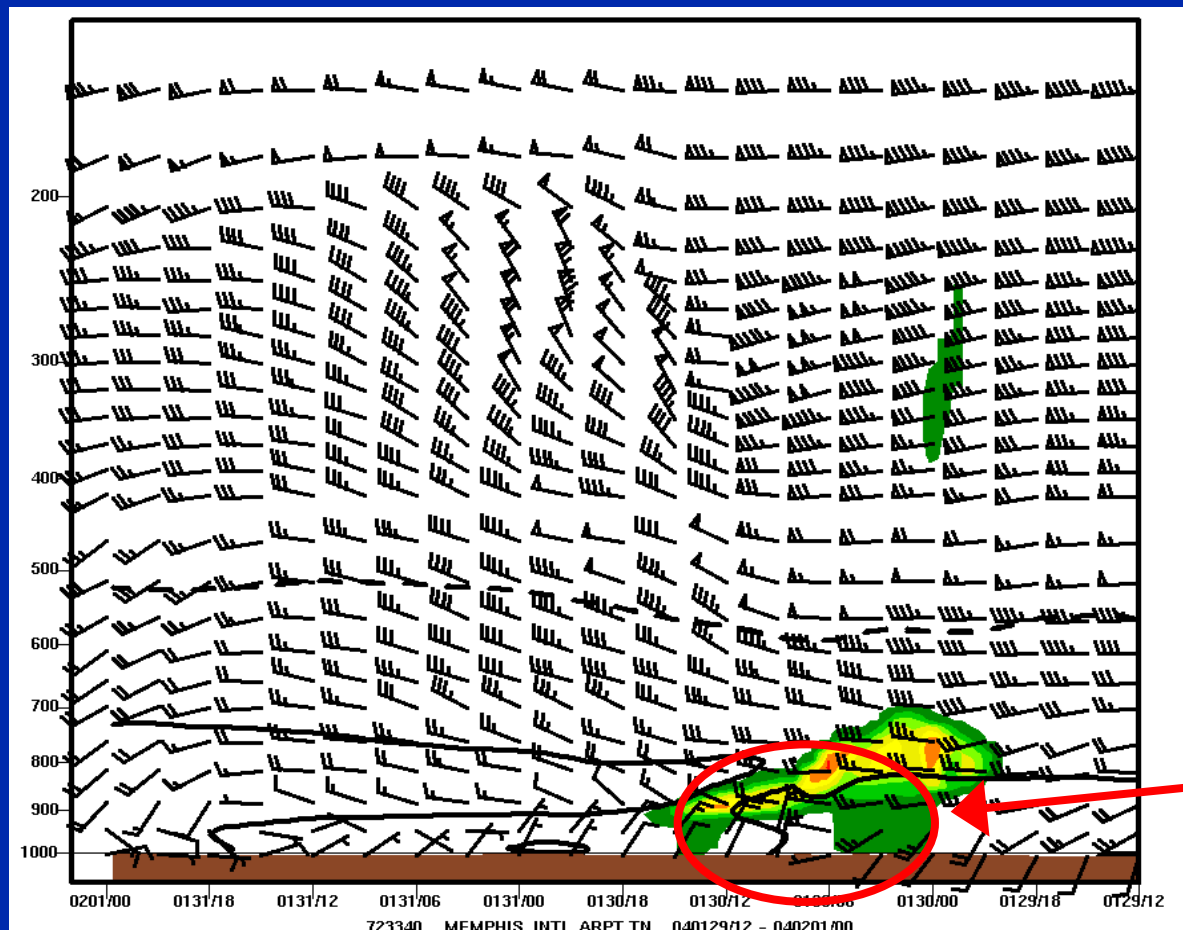


Time-height Series

- Use for studying vertical structure of weather features, such as wind shear and fronts
- Both observed and forecasted
- What to look for
 - Wind shift in time or height
 - Wind speed change in time or height
 - Temperature change in time or height
- Links – Forecast
 - <http://wwwt.emc.ncep.noaa.gov/mmb/etameteograms/>
- Links – Current
 - <http://www.profiler.noaa.gov/jsp/profiler.jsp>

Time-height Series - Forecast

Forecast time-height plot of wind, 0 °C line, 15 °C line, and cloud mixing ratios

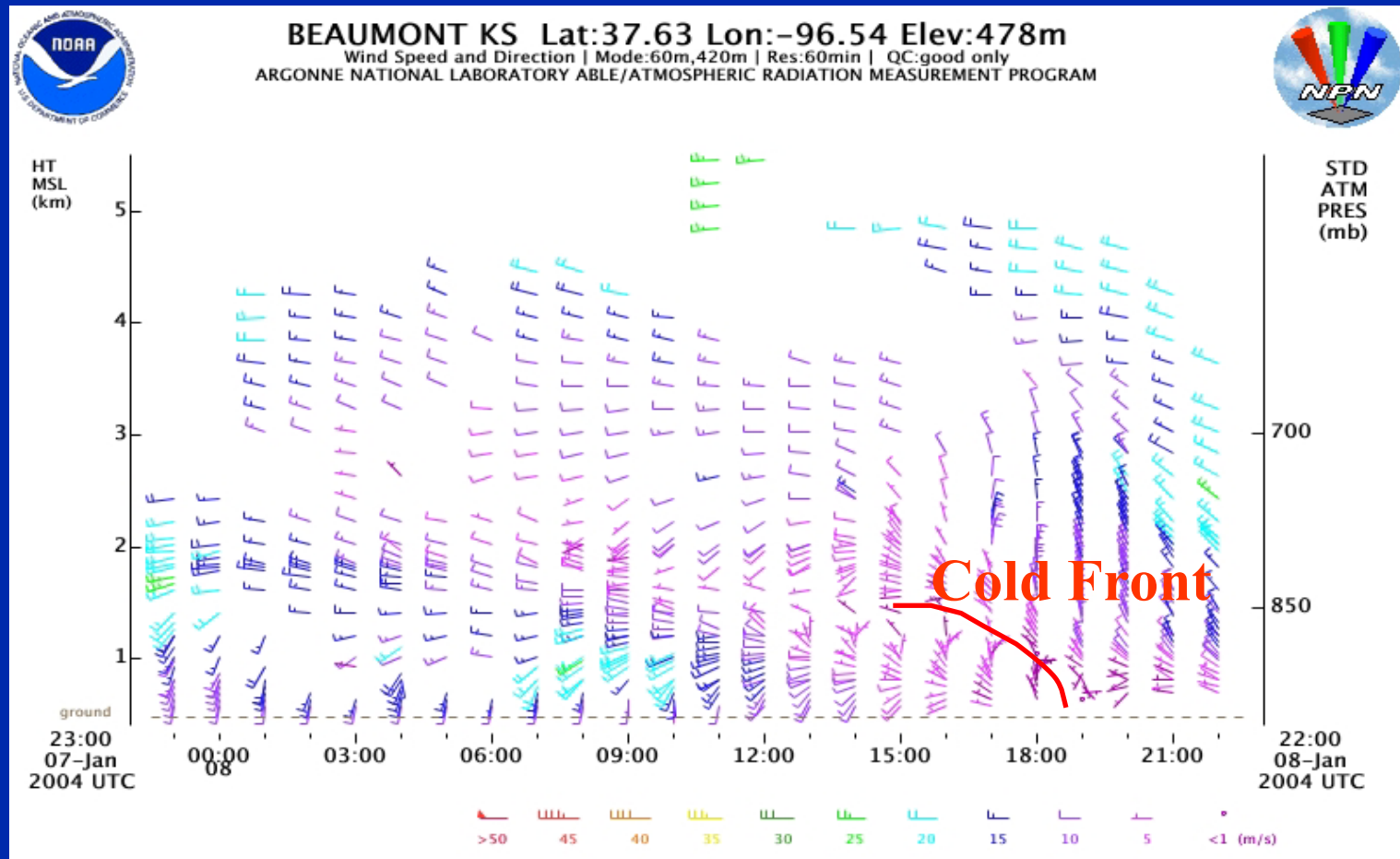


Cold
frontal
passage

<http://wwwt.emc.ncep.noaa.gov/mmb/etameteograms/>

Time-height Series – Real-time

- Time-height plot of observed wind data from a radar wind profiler



<http://www.profiler.noaa.gov/jsp/profiler.jsp>

MOS and FOUS

- MOS is statistically modified model data at specific points
- FOUS is direct model output at specific points in text format
- Used for obtaining specific numerical forecasts
- What to look for
 - Minimum and maximum temperatures
 - Trend in dew point temperature
 - Timing of wind shifts
 - Cloud cover
 - Aloft temperatures
- Links
 - Eta and GFS/MRF MOS graphics – <http://www.nws.noaa.gov/mdl/synop/products.shtml>
 - Eta, NGM, and MRF MOS text – <http://www.nws.noaa.gov/mdl/synop/products/bullform.all.htm>
 - Eta and NGM FOUS text – <http://twister.sbs.ohio-state.edu/models.html#fous>
 - All MOS and FOUS text products – http://www.met.tamu.edu/personnel/students/weather/weather_interface.html
 - NGM MOS help – <http://weather.cod.edu/notes/fous.html>
 - FOUS help – <http://weather.cod.edu/notes/output.html>

MOS

Current NWS MOS Forecast Products - Netscape

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop <http://www.nws.noaa.gov/mdl/synop/products.shtml> Print

AIM Home Bookmarks Met Links eLynah Hotmail My iWon STI Intranet Wx Info Page NWS-SFO EPA AIRNow Google Yellow pages

Current NWS MOS Forecast Products

Current MOS Forecast Products

[Product Documentation](#)

One-Stop MOS: AVN, Eta, and MRF MOS messages on a single page. During some times of the day, cycles may be different between the three packages.

AVN MOS (MAV)	MRF MOS (MEX)
Full Text Message	Full Text Message
Text Message By Station List	Text Message By Station List
Text Message By State Map	Text Message By State Map
Canadian Max/Min Guidance	Canadian Max/Min Guidance
Forecast Graphics	Forecast Graphics
Raw BUFR and GRIB Files	Raw BUFR and GRIB Files
Description	Description
Research Papers/TPBs	Research Papers/TPBs

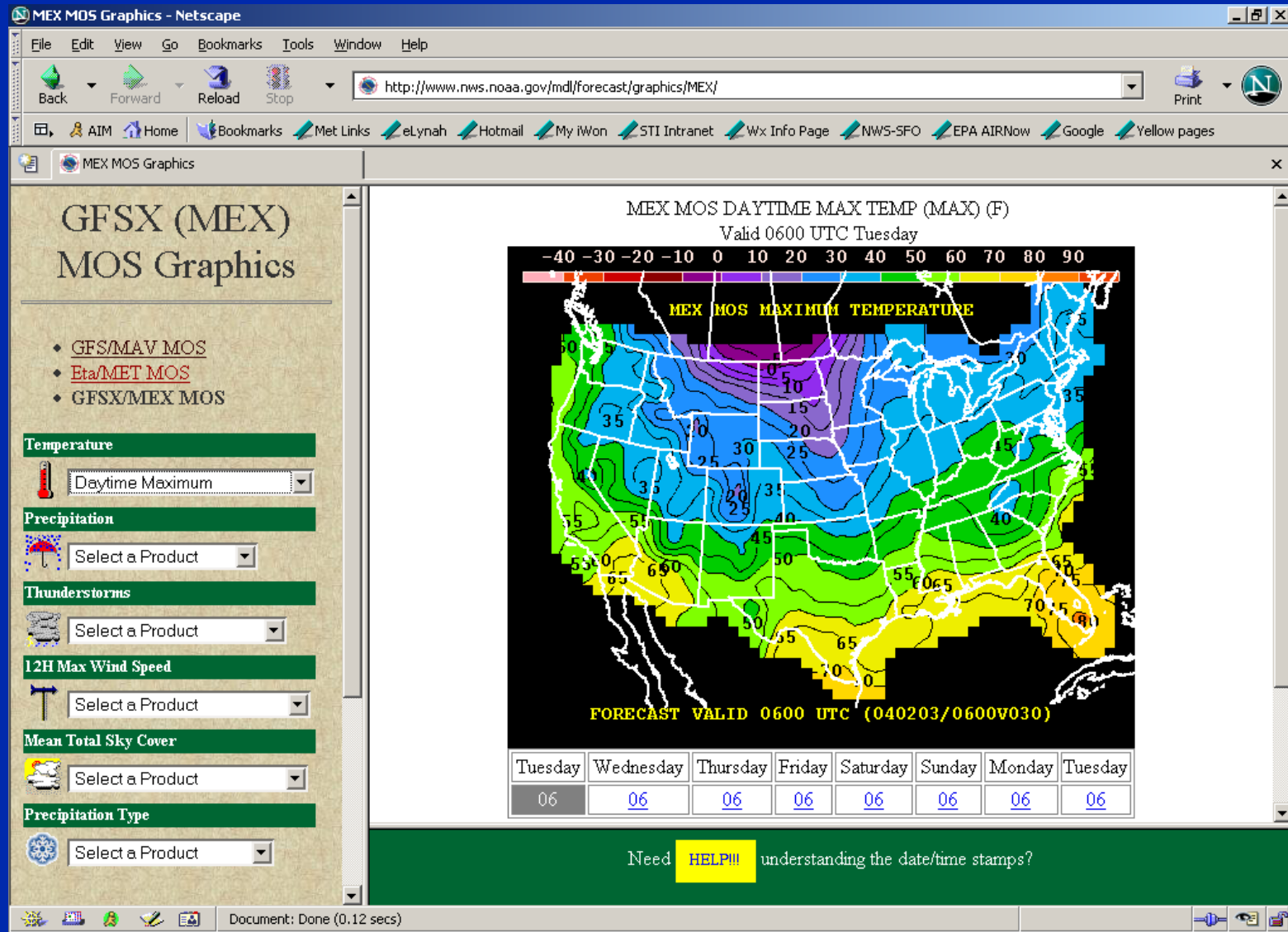
Eta MOS (MET)	Ensemble MOS
Full Text Message	Text Messages By Station List
Text Message By Station List	Individual Text Messages
Text Message By State Map	Ensemble Summary Message
Forecast Graphics	Description
Raw GRIB Files	
Description	
Research Papers/TPBs	

Coop MOS Products	Marine MOS Products
GFS-based Short-range Text Message	Marine MOS Forecast Guidance
	Text Messages By Station List NEW
	Marine MOS Description

Document: Done (0.49 secs)

<http://www.nws.noaa.gov/mdl/synop/products.shtml>

MOS – Graphics



MOS and FOUS – Text

Eta MOS

KCMH	ETA MOS GUIDANCE																1/24/2004		1200 UTC		
DT	/JAN 24/JAN 25																/JAN 26				
HR	18	21	00	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21	00		
N/X							3				26				26				40		
TMP	19	19	15	10	7	5	5	12	18	21	23	26	30	32	34	34	37	38	37		
DPT	10	6	4	2	-1	-3	-3	0	7	14	16	20	26	29	31	33	35	36	35		
CLD	OV	SC	CL	SC	BK	SC	BK	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV		
WDR	36	36	01	04	06	07	08	08	08	08	07	07	09	08	11	12	12	11	04		
WSP	13	09	06	04	02	05	05	08	07	07	10	12	11	09	08	07	05	06	09		
PO6			1		0		0	17	66	74	80				42			29			
P12							1		66		83							46			
Q06			0		0		0		0	2	2		2		1			0			
Q12							0		2		3							1			
T06		0/	0	0/	4	0/	0	3/	0	4/	0	9/	0	5/	0	2/	2	3/	6		
T12				0/	4			3/	0			9/	0			5/	2				

Eta FOUS

```

FOUS67 KWN0 081800
OUTPUT FROM ETA 18Z JAN 08 04
TTPTTR1R2R3 VVLI PSDDFF HHT1T3T5
DTW//855353 -4122 262802 28959189
06000776345 -1523 260408 25959088
12000935441 -1322 270413 24938988
18000884328 01423 310513 21918787
24000745530 -1323 310410 19918585
30000814229 -0824 330508 16908584
36000824825 00123 340301 14888483
42000814634 -0923 343205 15888582
48000736935 -1722 322309 16918682
    
```

GFS MOS

KMCI	GFSX MOS GUIDANCE																1/24/2004		0000 UTC	
FHR	24/ 36 48/ 60 72/ 84 96/108 120/132 144/156 168/180 192																			
SAT	24/	SUN	25/	MON	26/	TUE	27/	WED	28/	THU	29/	FRI	30/	SAT	31	CLIMO				
X/N	34/	26	28/	22	33/	18	45/	27	44/	31	44/	21	24/	10	24	18	37			
TMP	32/	29	27/	24	26/	20	38/	30	39/	34	37/	23	21/	13	19					
DPT	24/	23	26/	21	15/	13	21/	23	27/	28	24/	17	10/	6	6					
CLD	OV/	OV	OV/	OV	OV/	CL	PC/	PC	OV/	OV	OV/	PC	PC/	PC	PC					
WND	16/	15	14/	13	16/	13	15/	12	14/	13	15/	15	13/	12	13					
P12	8/	76	79/	43	24/	1	3/	2	10/	16	15/	10	12/	3	8	18	15			
P24			84/		44/		3/		10/		24/		26/		10		26			
Q12	0/	3	1/	1	0/	0	0/	0	0/	0	0/	0								
Q24			3/		1/		0/		0/		0/									
T12	1/	3	1/	3	0/	2	0/	1	1/	1	1/	1	0/	2	1					
T24		5		7		2		3		5		5		3						
PZP	30/	68	62/	42	12/	13	15/	14	16/	13	12/	17	17/	31	18					
PSN	21/	14	26/	45	76/	73	47/	24	24/	24	25/	34	76/	58	78					
PRS	13/	11	12/	12	12/	0	13/	13	8/	4	12/	11	8/	3	4					
TYP	S/	Z	Z/	Z	S/	S	S/	RS	RS/	RS	RS/	S	S/	Z	S					
SNW			1/		0/		0/		0/											

NGM MOS

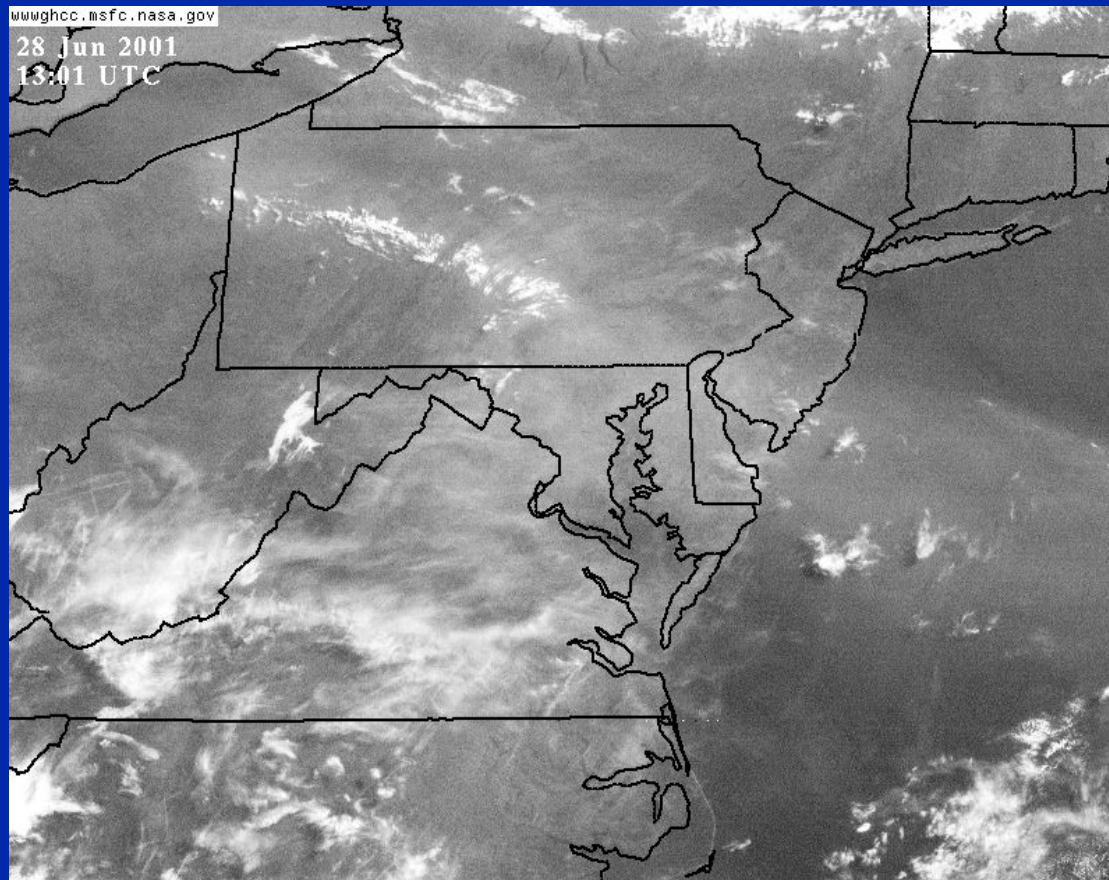
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DAY	/JAN	8 /JAN 9																/JAN 10			
HR	18	21	00	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21	00		
MN/MX							8				15				3				22		
TEMP	17	17	13	13	13	11	10	10	12	14	10	8	8	8	8	10	17	21	18		
DEWPT	8	7	5	5	7	6	5	5	4	4	3	3	3	3	4	6	11	14	14		
CLDS	OV	OV	OV	BK	OV	OV	OV	OV	BK	BK	BK	BK	BK	BK	OV	BK	BK	BK	BK		
WDIR	07	04	03	03	03	02	06	03	00	06	14	13	15	12	15	15	18	17	15		
WSPD	06	06	08	06	04	02	02	03	00	01	03	01	03	02	02	02	06	05	05		
POP06			5		8		4		12		8		5		11		10		9		
POP12							10				15				14				15		
QPF		0/			0/	0/0		0/0		0/0		0/0		0/0		0/0		0/0	0/0		
TSV06		0/	0	0/	0	0/	2	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0		
TSV12				0/	0			0/	0			0/	0			0/	0		0		
PTYPE	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S		
POZP	0	1	0	0	0	1	1	0	0	0	0	3		2		0		3			
POSN	96	99	100	99	99	99	99	99	99	100	100	100	100	97	98		99		97		
SNOW		0/		0/		0/0		1/		0/1		0/		1/1		1/		0/1			
CIG	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
VIS	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5		
OBVIS	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N		

Satellite Imagery

- Shows snapshot of the earth as seen from the satellite
- What to look for
 - Clouds
 - Smoke and haze
 - Snow cover
 - Water vapor
 - Cloud top and/or ground temperatures
- Links
 - <http://www.ghcc.msfc.nasa.gov/GOES/>
 - <http://www.rap.ucar.edu/weather/satellite/>
 - <http://www.osei.noaa.gov/>

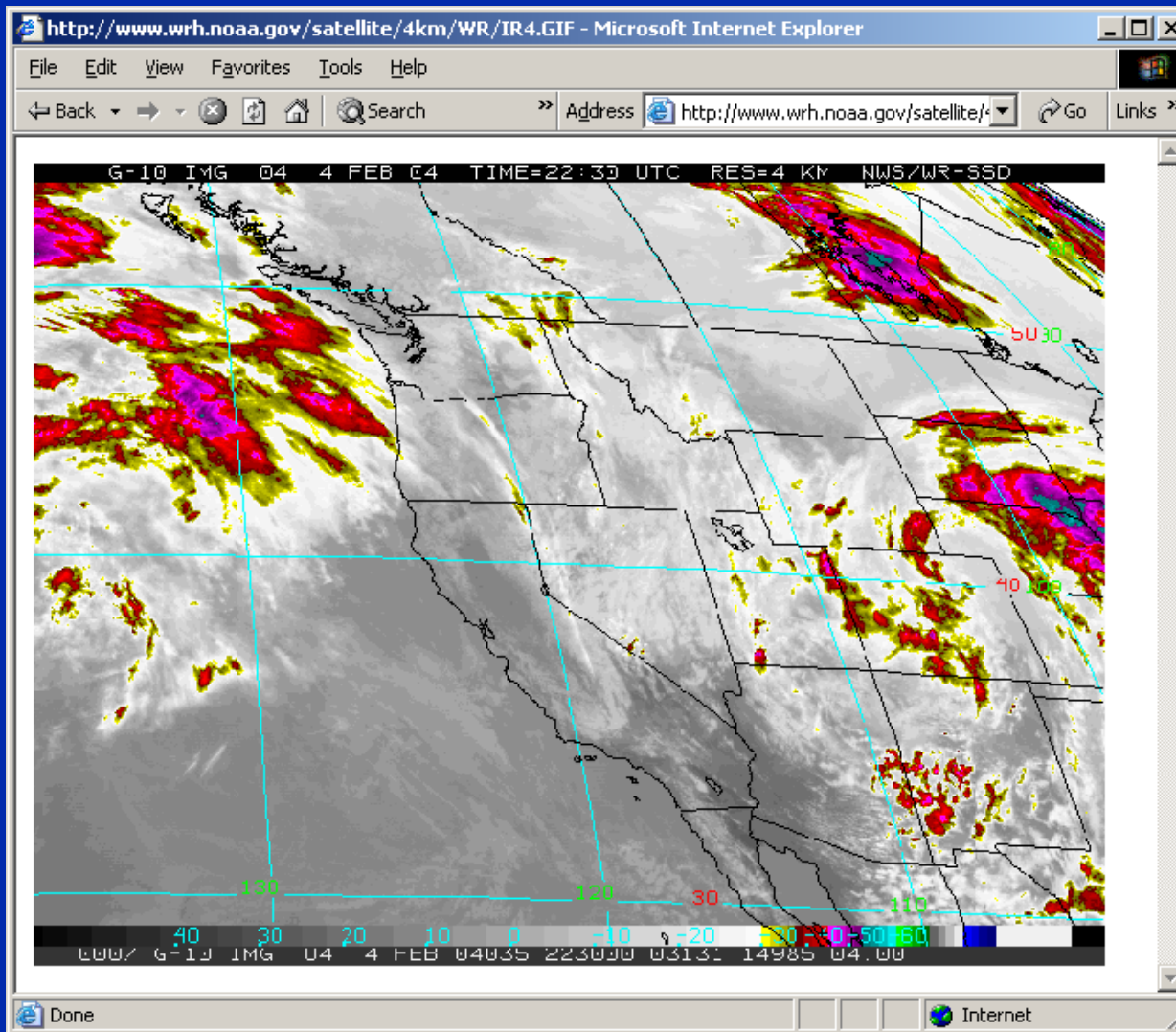
Satellite Imagery - Visible

<http://www.ghcc.msfc.nasa.gov/GOES/>



**Enhanced GOES Visible Image
1300 UTC June 28, 2001**

Satellite Imagery – Infrared

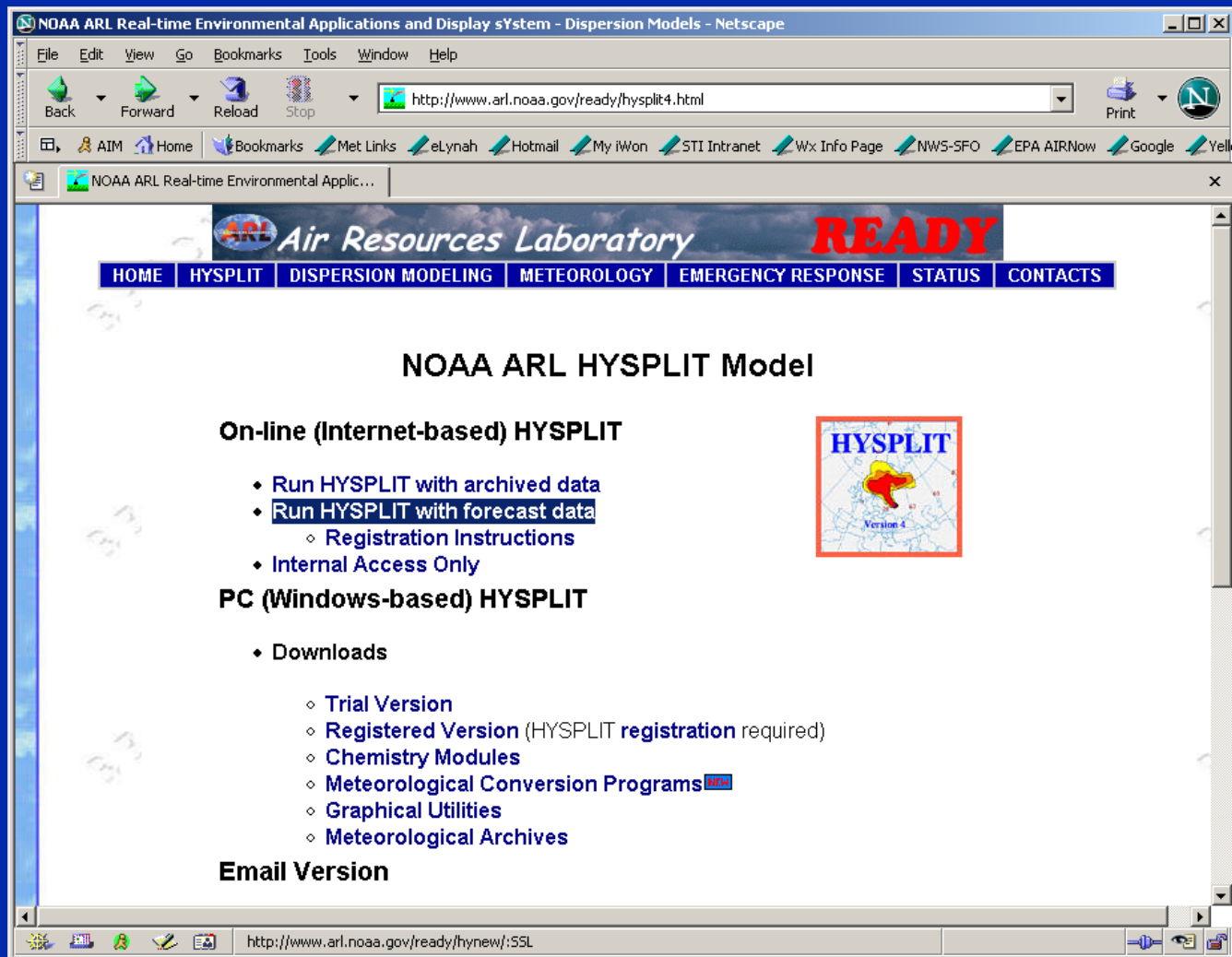


HYSPLIT (1 of 11)

- A trajectory model that can be used to determine pollutant transport
- Uses model data (historic or forecasted)
- Steps to use HYSPLIT
 1. Register as a user (free)
 2. Select Run HYSPLIT with forecast data
 3. Click on CLICK HERE under To access HYSPLIT with forecast meteorological data
 4. Select Compute Trajectories
 5. Select a data source
 6. Select a starting location by entering a station ID, latitude and longitude, or clicking on the map
 7. Set initialization parameters
 8. Select Request Trajectory
 9. Select HYSPLIT RUN RESULTS
- Link – <http://www.arl.noaa.gov/ready/hysplit4.html>

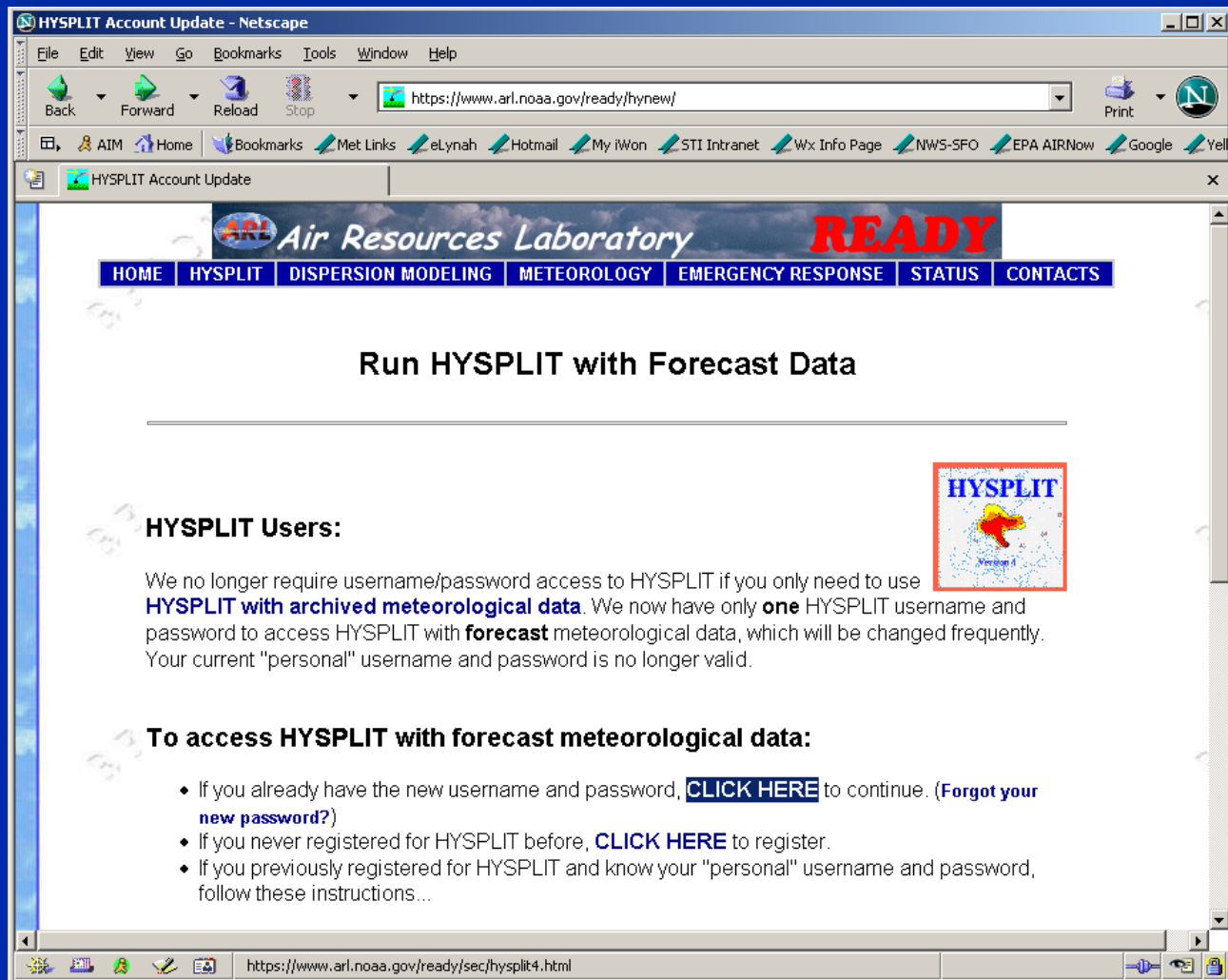
HYSPLIT (2 of 11)

Select Run HYSPLIT with forecast data



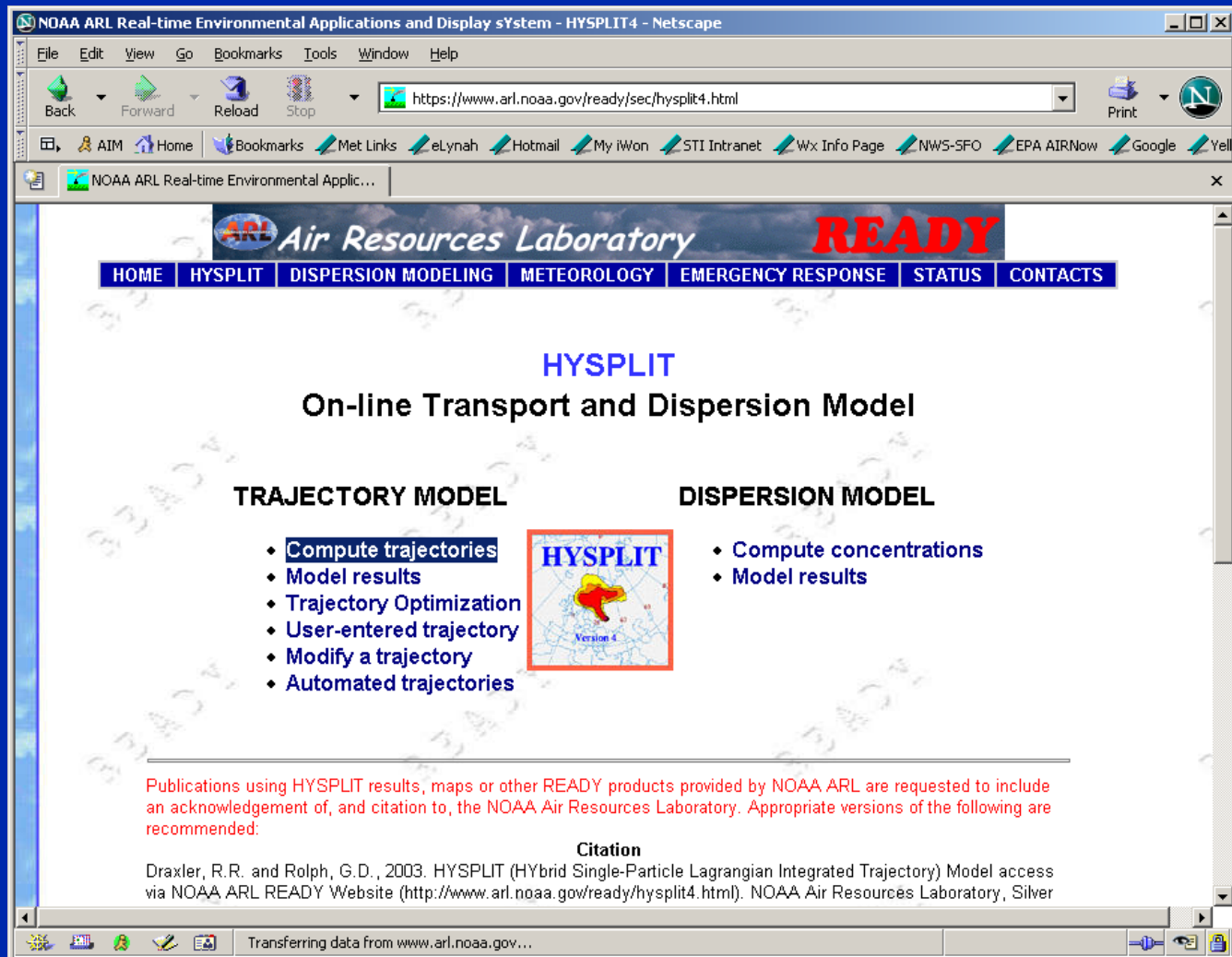
HYSPLIT (3 of 11)

Select **CLICK HERE**



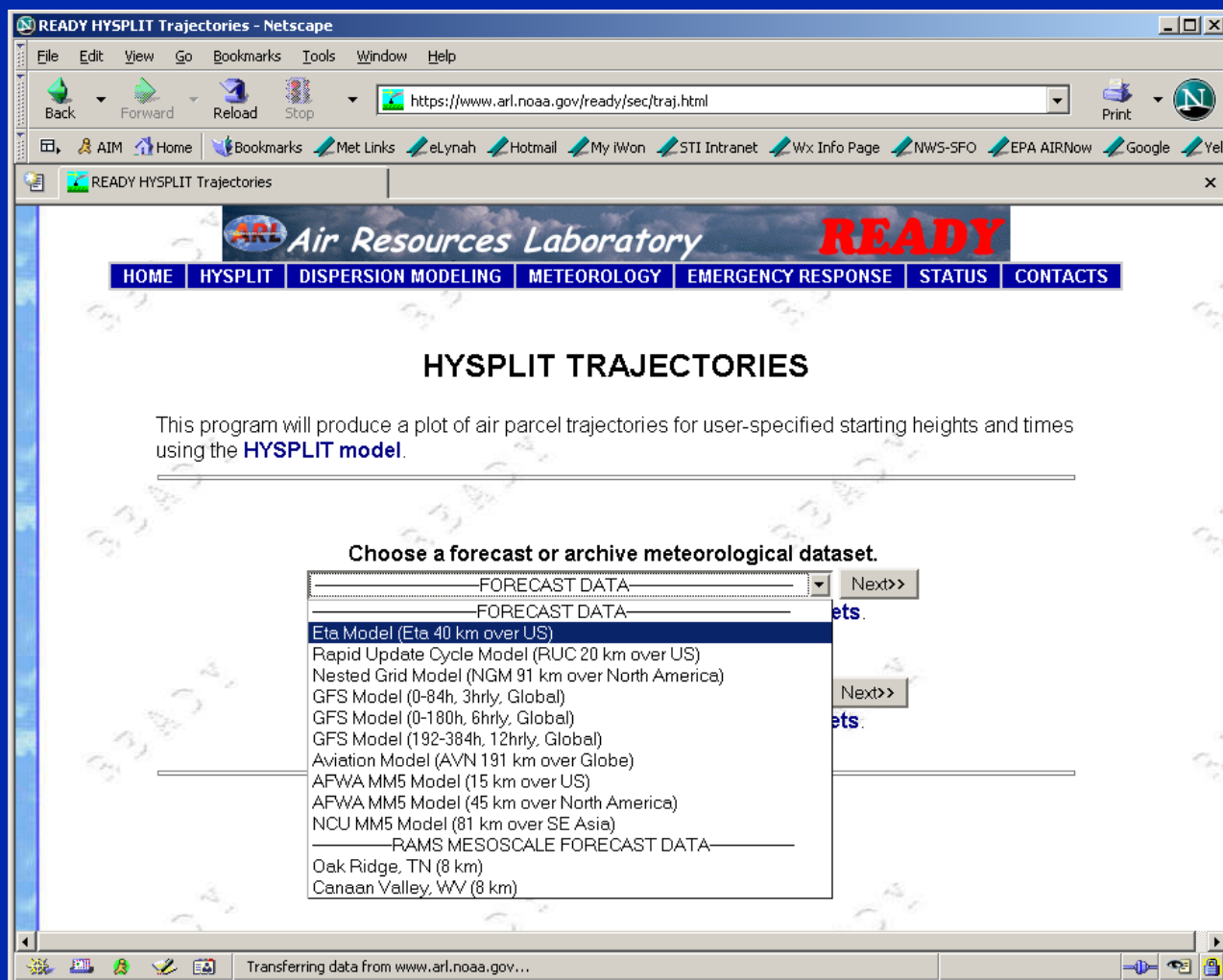
HYSPLIT (4 of 11)

Select Compute Trajectories



HYSPLIT (5 of 11)

Select a data source



HYSPLIT (6 of 11)

Select a starting location

READY HYSPLIT Trajectory Model using Eta 40 km - Netscape

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop <https://www.arl.noaa.gov/hysplitps-bin/trajsrc.pl?metdata=Eta+40+km> Print

AIM Home Bookmarks Met Links eLynah Hotmail My iWon STI Intranet Wx Info Page NWS-SFO EPA AIRNow Google Yellow pages

READY HYSPLIT Trajectory Model using Et...

Eta 40 km

Choose a Trajectory Starting Location...

1. Enter a WMO station ID (i.e., dca, lfpo) or a latitude/longitude pair (decimal degrees, XXX.XX) and then click the next button:

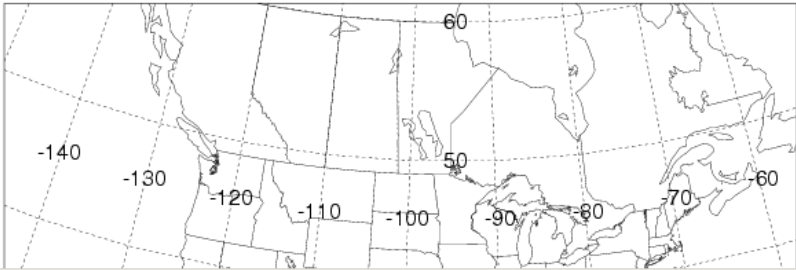
WMO ID: [Station lookup](#)

Latitude (South is negative, i.e. -10.95) :

Longitude (West is negative, i.e. -140.95) :

Or

2. click on a location on the following map(s):



Transferring data from www.arl.noaa.gov...

HYSPLIT (7 of 11)

Set initialization parameters (see HYSPLIT initialization parameters)

READY HYSPLIT Trajectory Model using Eta 40 km - Netscape

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop <https://www.arl.noaa.gov/hysplitps-bin/traj1.pl> Print

AIM Home Bookmarks Met Links eLynah Hotmail My iWon STI Intranet Wx Info Page NWS-SFO EPA AIRNow Google Yell

READY HYSPLIT Trajectory Model using Et...

The current Eta 40 km model has data beginning at 1/25/04 1800 UTC
and has 84 hours of forecast data available from the initialization time of the model.

Help me with the inputs.

What is UTC time?

Trajectory direction:	help	<input checked="" type="radio"/> Forward			
		<input type="radio"/> Backward (You must change the default start time!)			
Vertical Motion:	help	<input checked="" type="radio"/> Model vertical velocity			
		<input type="radio"/> Isobaric			
		<input type="radio"/> Isentropic			
Start time (UTC):	help	year	month	day	hour
		04	01	25	18
Total run time (hours):	help	84			
Start latitude (degrees):	help	39.18			
Start longitude (degrees):	help	-76.67			
Start height 1:	help	500	<input checked="" type="radio"/> meters AGL		<input type="radio"/> meters AMSL
Start height 2:		0			
Start height 3:		0			

Document: Done (1.623 secs)

HYSPLIT (8 of 11)

Select Request trajectory

READY HYSPLIT Trajectory Model using Eta 40 km - Netscape

File Edit View Go Bookmarks Tools Window Help


Back Forward Reload Stop <https://www.arl.noaa.gov/hysplitps-bin/traj1.pl> Print

AIM Home Bookmarks Met Links eLynah Hotmail My iWon STI Intranet Wx Info Page NWS-SFO EPA AIRNow Google Yell

READY HYSPLIT Trajectory Model using Et...

Plot projection:	help	<input checked="" type="radio"/> Default	<input type="radio"/> Polar	<input type="radio"/> Lambert	<input type="radio"/> Mercator
Vertical plot height units:	help	<input type="radio"/> Pressure	<input checked="" type="radio"/> meters AGL		
Label Interval:	help	<input type="radio"/> No labels	<input type="radio"/> 6 hours	<input type="radio"/> 12 hours	<input checked="" type="radio"/> 24 hours
Zoom factor:	help	<input type="radio"/> 0 (far)	<input type="radio"/> 45	<input checked="" type="radio"/> 75	<input type="radio"/> 100 (close)
Distance circle overlay:	help	<input checked="" type="radio"/> None	<input type="radio"/> Auto		
Create Java Animation?	help	<input type="radio"/> Yes	<input checked="" type="radio"/> No		
Graphic size (dpi):	help	<input type="radio"/> 72	<input type="radio"/> 96	<input checked="" type="radio"/> 120	
Create Postscript file?	help	<input type="radio"/> Yes	<input checked="" type="radio"/> No		
Plot meteorological field along trajectory	help	<input type="radio"/> Yes	<input checked="" type="radio"/> No	Note: Only choose one meteorological variable from below to plot	
Dump meteorological data along trajectory:	help	<input type="checkbox"/> Potential Temperature (K)	<input type="checkbox"/> Ambient Temperature (K)	<input type="checkbox"/> Rainfall (mm per hr)	<input type="checkbox"/> Mixed Layer Depth (m)
					<input type="checkbox"/> Relative Humidity (%)

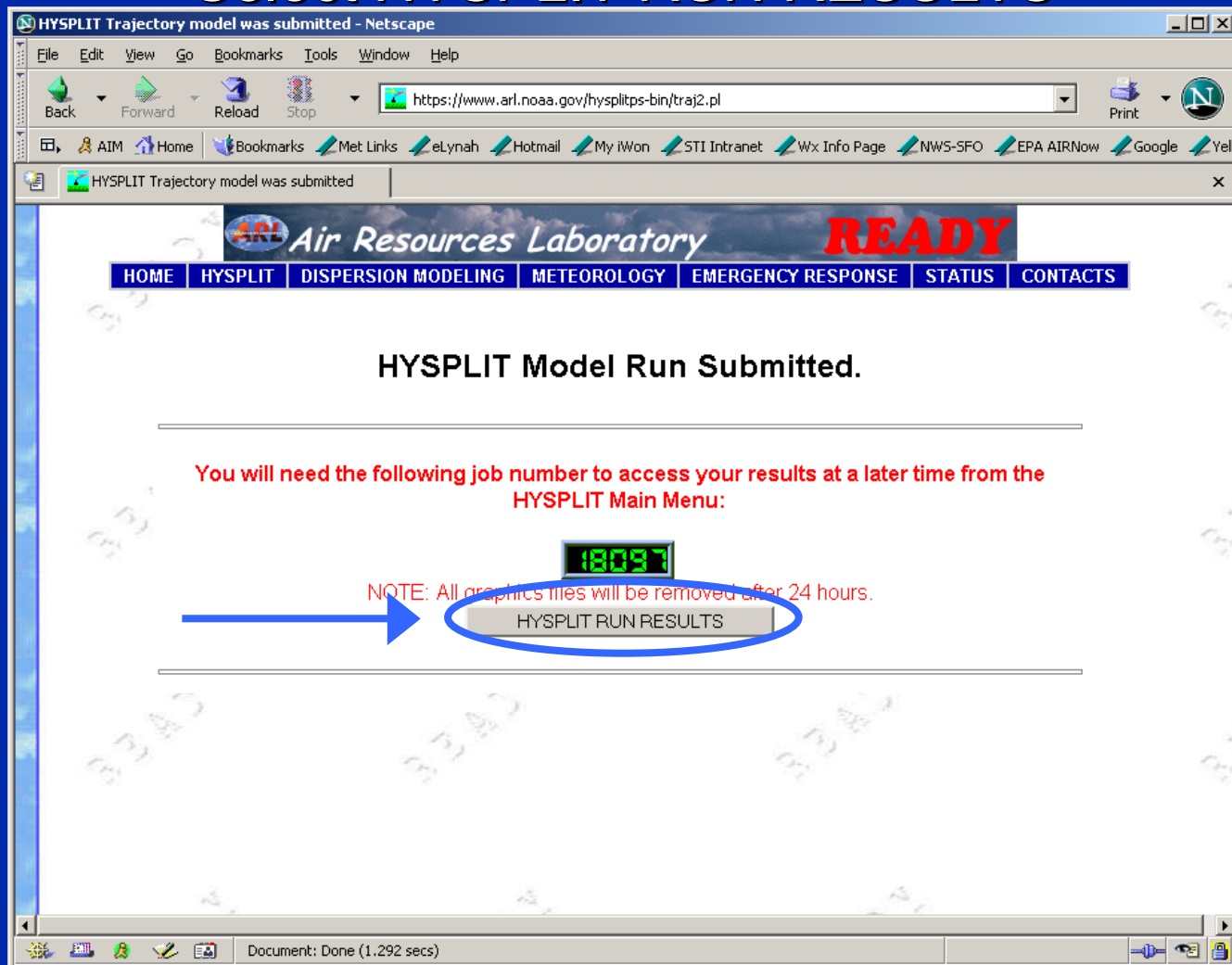
IMPORTANT ... You may submit only one trajectory calculation at a time to the server. When the calculation is finished you will be permitted to submit another one.



<https://www.arl.noaa.gov/ready/sec/trajinfo.html>

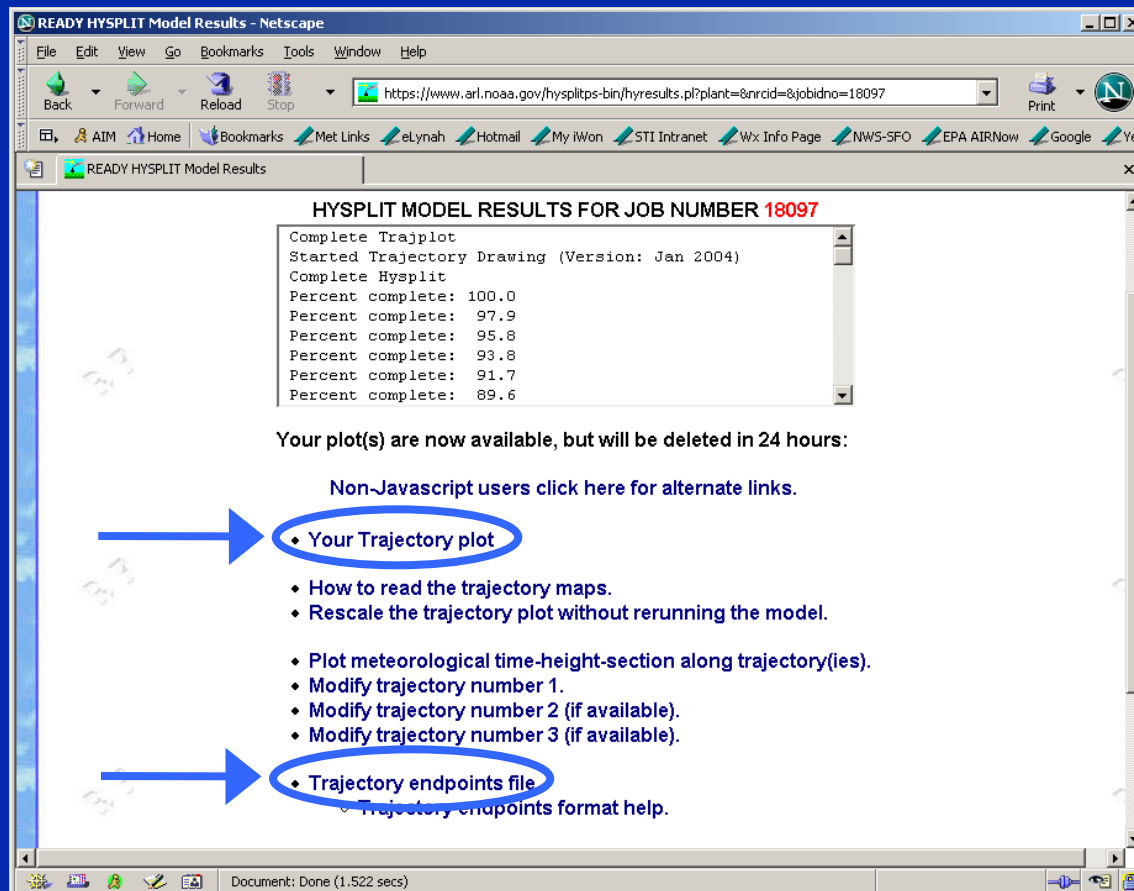
HYSPLIT (9 of 11)

Select HYSPLIT RUN RESULTS



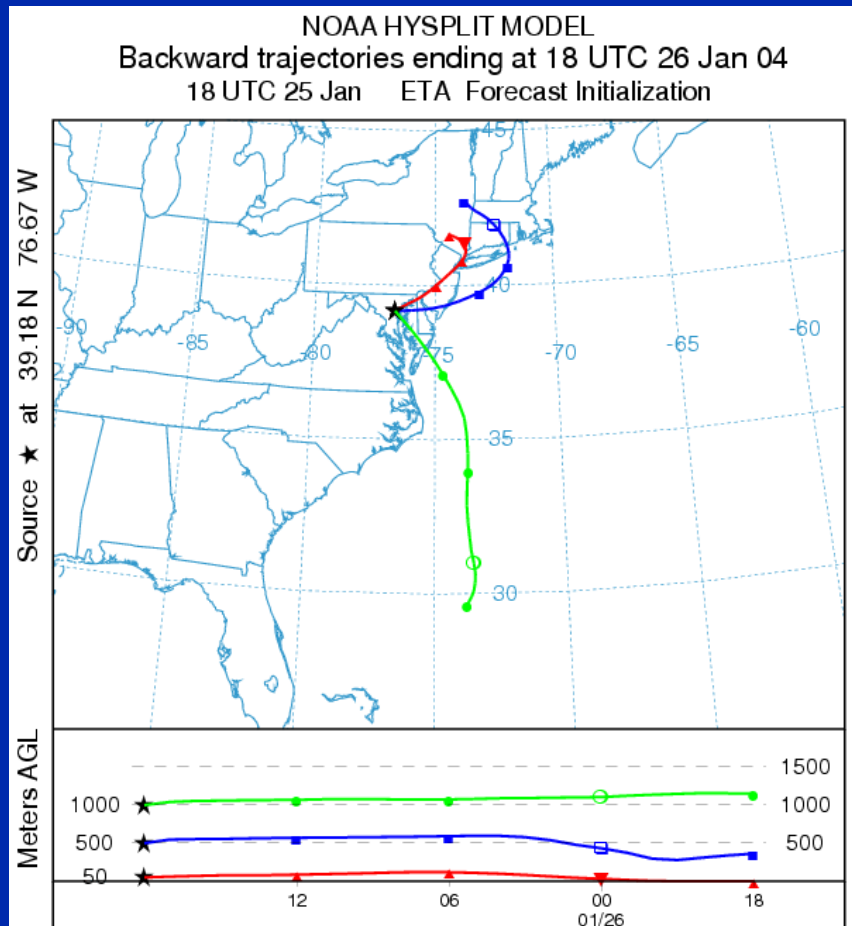
HYSPLIT (10 of 11)

Select Your Trajectory plot for graphic output
OR
Select Trajectory endpoints file for text output



HYSPLIT (11 of 11)

Graphic output



Text output

Netscape

File Edit View Go Bookmarks Tools Window Help

```

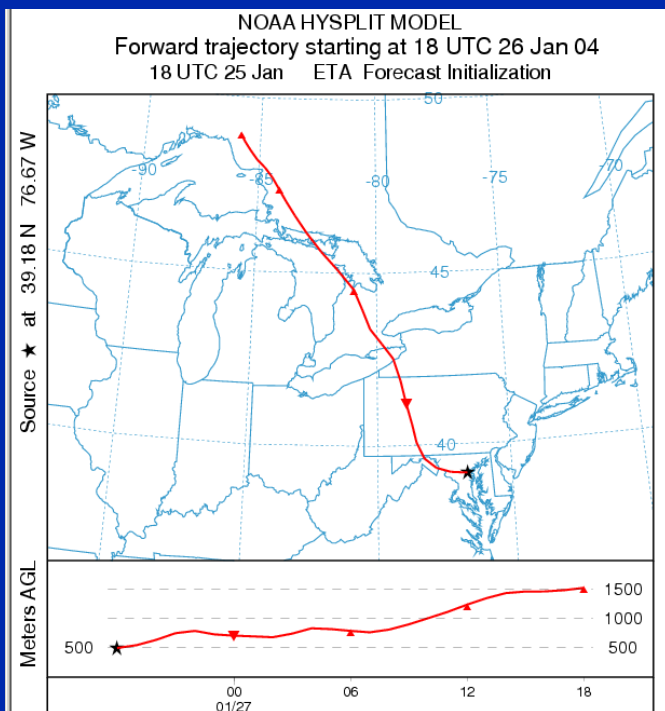
1
ETA      4      1      25      18      0
3BACKWARDISOBARIC
4      1      26      18      39.180      -76.670      50.0
4      1      26      18      39.180      -76.670      500.0
4      1      26      18      39.180      -76.670      1000.0
1PRESSURE
1      1      4      1      26      18      0      24      0.0      39.180      -76.670      50.0      1009.2
2      1      4      1      26      18      0      24      0.0      39.180      -76.670      500.0      952.4
3      1      4      1      26      18      0      24      0.0      39.180      -76.670      1000.0      892.9
1      1      4      1      26      17      0      23      -1.0      39.304      -76.405      60.8      1011.9
2      1      4      1      26      17      0      23      -1.0      39.203      -76.000      546.9      953.6
3      1      4      1      26      17      0      23      -1.0      38.896      -76.345      1041.0      894.9
1      1      4      1      26      16      0      22      -2.0      39.424      -76.119      69.4      1013.0
2      1      4      1      26      16      0      22      -2.0      39.252      -75.301      553.1      954.8
3      1      4      1      26      16      0      22      -2.0      38.605      -76.017      1055.2      894.8
1      1      4      1      26      15      0      21      -3.0      39.550      -75.797      77.2      1010.6
2      1      4      1      26      15      0      21      -3.0      39.351      -74.627      555.0      954.8
3      1      4      1      26      15      0      21      -3.0      38.295      -75.695      1058.7      894.1
1      1      4      1      26      14      0      20      -4.0      39.695      -75.487      77.3      1010.6
2      1      4      1      26      14      0      20      -4.0      39.495      -74.041      561.4      954.8
3      1      4      1      26      14      0      20      -4.0      37.958      -75.370      1064.0      893.3
1      1      4      1      26      13      0      19      -5.0      39.861      -75.199      80.6      1011.2
2      1      4      1      26      13      0      19      -5.0      39.645      -73.549      567.3      954.2
3      1      4      1      26      13      0      19      -5.0      37.583      -75.034      1066.4      892.7
1      1      4      1      26      12      0      18      -6.0      40.041      -74.923      87.0      1009.6
2      1      4      1      26      12      0      18      -6.0      39.785      -73.144      570.7      954.2
3      1      4      1      26      12      0      18      -6.0      37.146      -74.683      1068.8      891.8
1      1      4      1      26      11      0      17      -7.0      40.218      -74.664      92.7      1009.2
2      1      4      1      26      11      0      17      -7.0      39.919      -72.821      574.1      954.3
3      1      4      1      26      11      0      17      -7.0      36.668      -74.342      1076.5      891.8
1      1      4      1      26      10      0      16      -8.0      40.375      -74.439      99.3      1008.8
2      1      4      1      26      10      0      16      -8.0      40.048      -72.574      576.8      953.9
3      1      4      1      26      10      0      16      -8.0      36.204      -74.045      1081.1      891.4
1      1      4      1      26      9      0      15      -9.0      40.505      -74.249      107.9      1010.1
2      1      4      1      26      9      0      15      -9.0      40.174      -72.384      579.5      953.0
3      1      4      1      26      9      0      15      -9.0      35.713      -73.826      1079.6      891.9
1      1      4      1      26      8      0      14      -10.0      40.618      -74.088      116.7      1010.4
2      1      4      1      26      8      0      14      -10.0      40.309      -72.225      582.6      952.0
3      1      4      1      26      8      0      14      -10.0      35.141      -73.733      1074.2      893.1

```

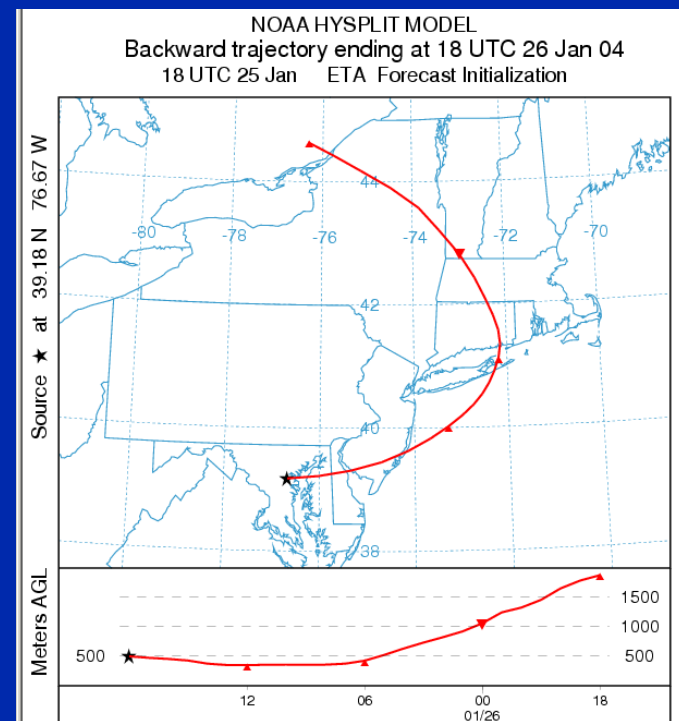
Document: Done (0.882 secs)

HYSPLIT – Initialization Parameters (1 of 7)

- Forward or backward
 - Forward trajectories begin at the selected location and time and progress forward in time and distance.
 - Backward trajectories end at the selected location and time and progress backward in time and distance.



24-hr forward trajectory



24-hr backward trajectory

HYSPLIT – Initialization parameters (2 of 7)

- Vertical motion
 - Model vertical velocity (default): parcel moves with model vertical motion
 - Isobaric: parcel follows constant pressure surfaces
 - Isentropic: parcel follows constant temperature surfaces
 - Recommend using all and comparing results
- Start time
 - Start time is the time when the trajectory will be at the selected location
 - For forward trajectories, start time is the begin time of the trajectory
 - For backward trajectories, start time is the end time of the trajectory

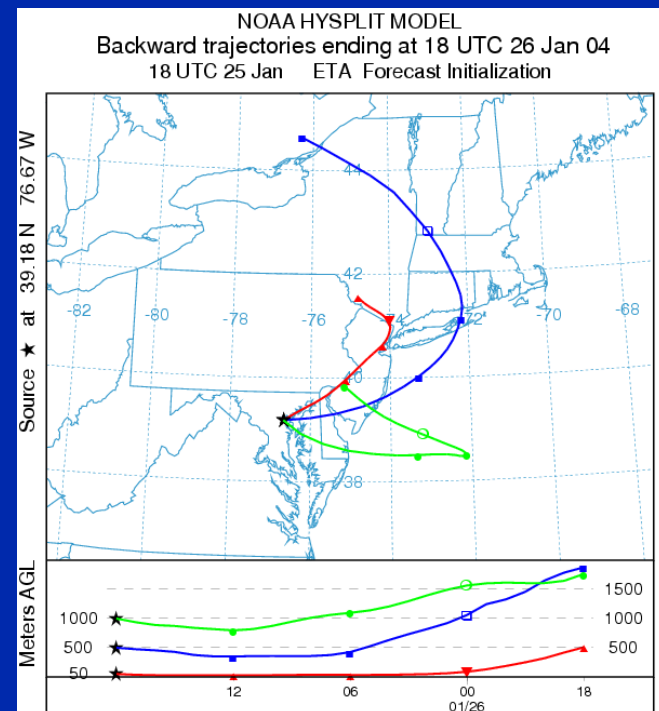
HYSPLIT – Initialization Parameters (3 of 7)

- Total run time
 - Amount of time to be represented by the trajectory
 - The run time and start time combination must fall within the range of the model output when using HYSPLIT as a forecast tool. For example, with a start time of 48 hours after model initialization, a 72-hr forward trajectory would exceed the available forecast periods of the Eta model. Likewise, with a start time of 48 hours after model initialization, a 72-hr backward trajectory would require data prior to the model initialization.
- Start latitude/longitude
 - Values default to what was input on the previous page
 - Can be manually changed

HYSPLIT – Initialization Parameters (4 of 7)

- Start heights 1, 2, and 3
 - Trajectories may be computed for up to 3 heights (in meters)
 - Heights must be greater than 0 m and less than 21,000 m
 - To output a trajectory for only one height, enter 0 for the remaining heights
 - For air quality, we recommend 50-100 m, 300-500 m, and 1000-2000 m

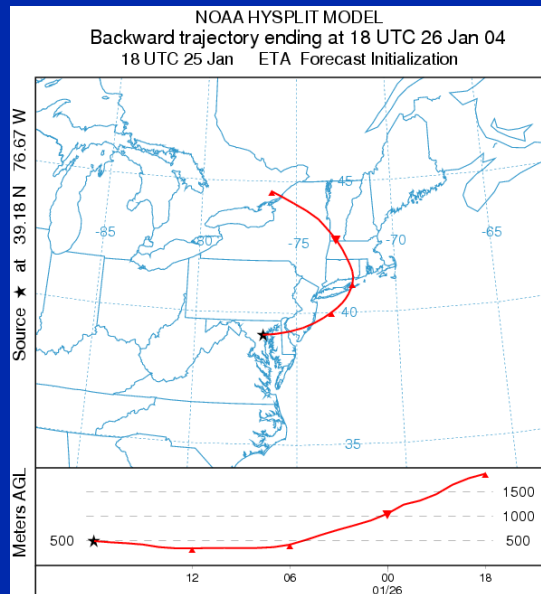
24-hr backward trajectories
at 50 m, 500 m, and 1000 m
above ground level



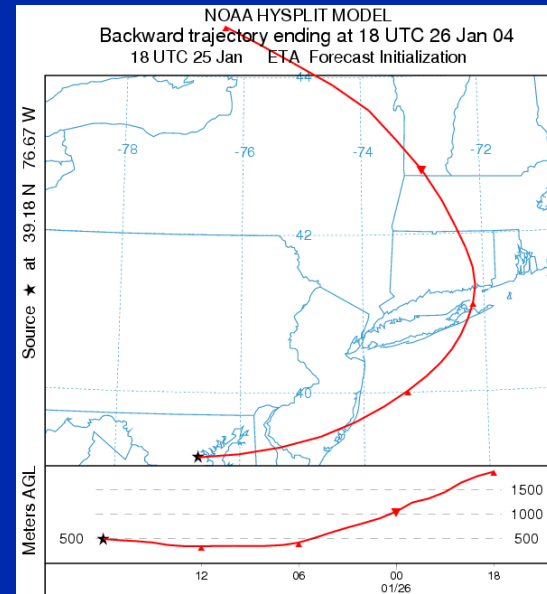
HYSPLIT – Initialization Parameters (5 of 7)

- Plot projection
 - Default centers the plot on the selected location
 - Polar, Lambert, and Mercator also options
- Vertical plot height units: meters above ground level or pressure
- Label interval: default is six hours
- Zoom factor: varies based on trajectory length

Zoom = 0 (far)



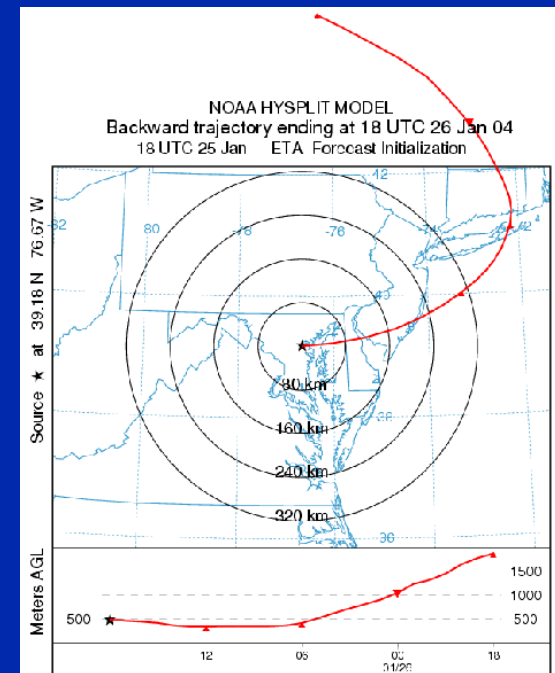
Zoom = 100
(close)



HYSPLIT – Initialization Parameters (6 of 7)

- Distance circle overlay
 - Plots concentric circles showing distance (in km) from the start point of the trajectory
- Create Java animation
 - This option will produce animated air parcel trajectories moving across the map and is controlled by the user
- Graphic size
 - Three size choices; middle choice (96 dpi) is the default

Adding distance circles can override other set preferences (zoom and map size in this example)



HYSPLIT – Initialization Parameters (7 of 7)

- Create postscript file (Y/N?)
- Plot meteorological field along trajectory (Y/N?)
- If previous answer is yes, select one if the following from Dump meteorological field along trajectory:
 - Potential temperature (K)
 - Ambient temperature (K)
 - Rainfall (mm/hr)
 - Mixed layer depth (m)
 - Relative humidity (%)

Forecast Submittal

AIRNow Forecast Submittal System

- Web interface for submitting air quality forecasts to AIRNow
- Can submit forecasts for multiple cities at one time.

The screenshot shows the AIRNow Forecast Submittal System web interface in a Netscape browser window. The URL is <http://www.airnowdata.org/forecast/index.cfm?SelCityID=35&ParamID=2>. The page title is "AIRNOW Forecast System".

Standard Forecast | [Bulk Forecast](#) | [Set Defaults](#) | [Query Database](#) | [Verification Sites](#) | [Forecast Accuracy](#)

Current Date: Monday January 26, 2004
Organization: Sonoma Technology
City: Detroit (MI)
Display Forecast for: PM2.5

Day	Yesterday (Observed) Sun 1/25	Today Mon 1/26	Next Day Tue 1/27	Day 2 Wed 1/28	Day 3 Thu 1/29	Day 4 Fri 1/30	Day 5 Sat 1/31
Pollutant	PM2.5	PM2.5	PM2.5	PM2.5	PM2.5	PM2.5	PM2.5
AQI Number	45	13	19	0	0	0	0
AQI Category							
Good	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Moderate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unhealthy for Sensitive Groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unhealthy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Very Unhealthy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Action Day		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Discussion	Today and tomorrow, moderate to strong easterly winds and snow showers will disperse particles in the air, leading to Good PM2.5 levels.						

AirNowdata.org/forecast/

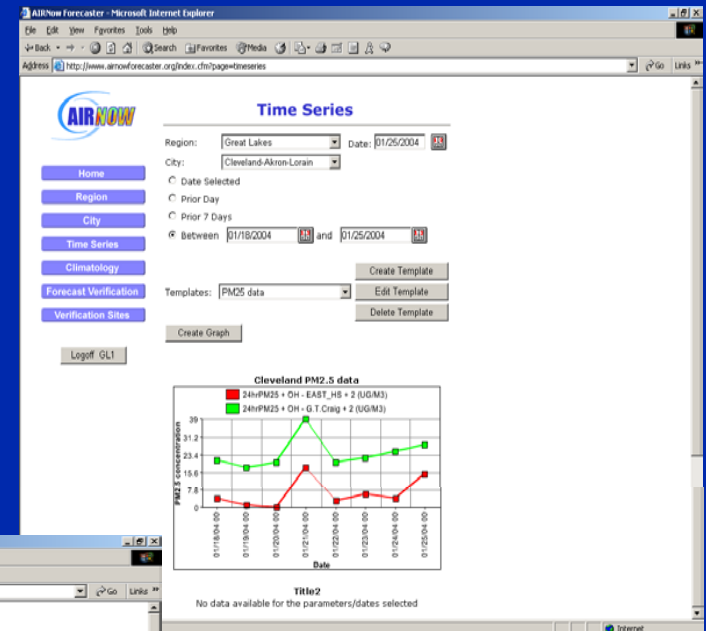
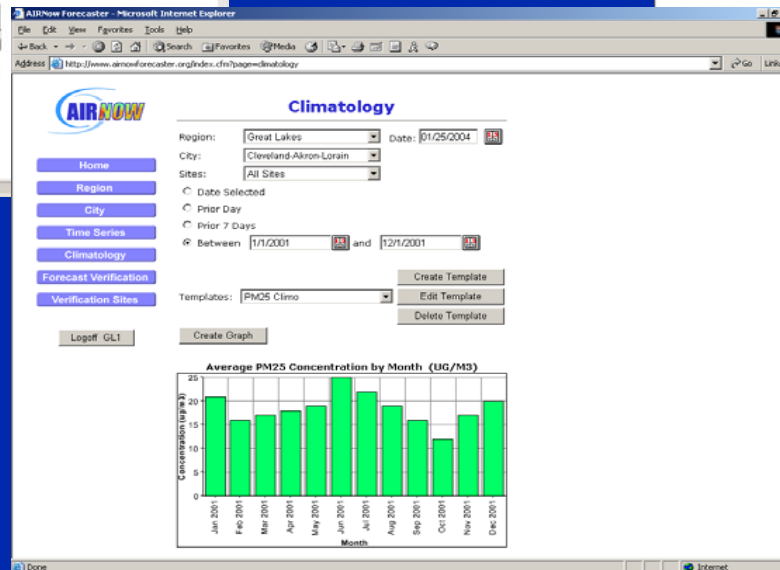
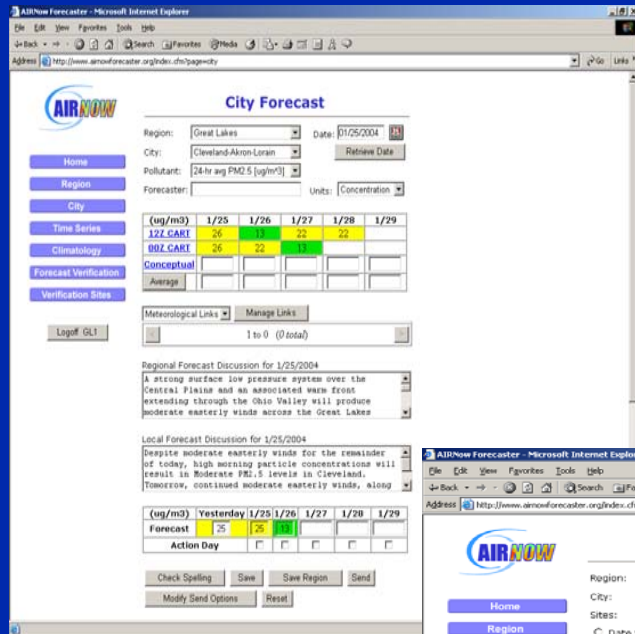
Forecast Creation (1 of 2)

AIRNowForecaster

- A centralized, web-based system that allows state and local air quality agency forecasters to quickly produce air quality forecasts on a daily basis
- Features
 - Customizable meteorological and air quality forecasting web links
 - Regional and local forecast discussions
 - Ability to send out forecasts automatically to the AIRNow Forecast Submittal System
 - Incorporation of objective forecasting tools
 - Storage of forecasts and discussions for each city
 - Quick access to past forecast data and meteorological and air quality data
 - Ability to create time series and climatological plots
 - Ability to compute forecast verification statistics
- www.AIRnowForecaster.org

Forecast Creation (2 of 2)

www.AIRNowForecaster.org



Products Under Development – Web Portal

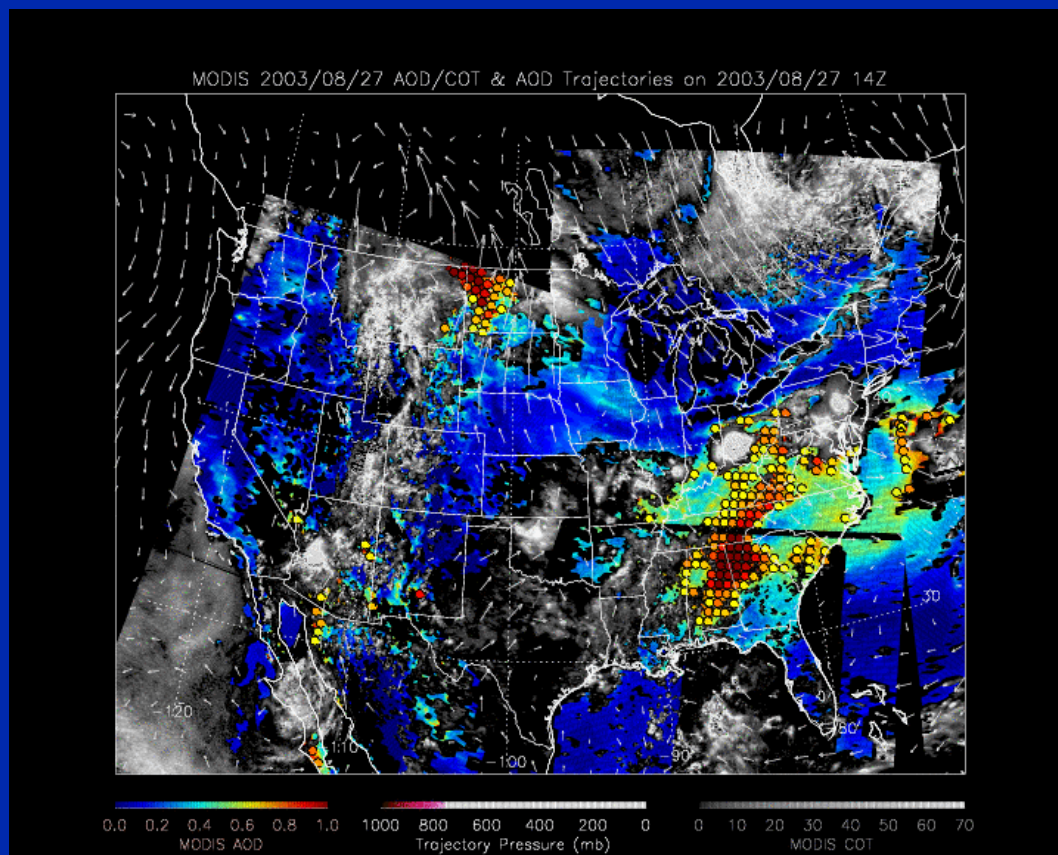
- In planning stage
- One location for air-quality-focused forecast preparation information
- Provides specific information on air quality currently not widely available on the web, including
 - Custom meteorological model output
 - Forecast soundings
 - Backward trajectories coupled with current air quality observations
 - Ventilation indices
 - Boundary layer products
 - Others?
- Allows access to emerging technologies in association with partners (e.g. NOAA and NASA)
- Forecaster communications forum
 - Regional forecast discussions
 - Exchange information on data and/or models in real-time

Products Under Development – MODIS (1 of 2)

- MODIS forecast products (courtesy of Jim Szykman, NASA)
 - Regional summary plots of MODIS Aerosol Optical Depth and Cloud Optical Thickness
 - MODIS Aerosol Optical Depth 48 hour Air Parcel Forecast Trajectories
 - Composite PM_{2.5}/MODIS Aerosol Optical Depth Data Fusion 3-day Animation
 - Time-series between MODIS Aerosol Optical Depth and PM_{2.5} (1-hr and 24-hr) Mass Concentration
 - National Correlation Map between PM_{2.5} and MODIS Aerosol Optical Depth
- Link
 - <http://idea-aqi.larc.nasa.gov> (log-in required)
 - Contact Jim Szykman (james.szykman@nasa.gov) to set up an account

Products Under Development – MODIS (2 of 2)

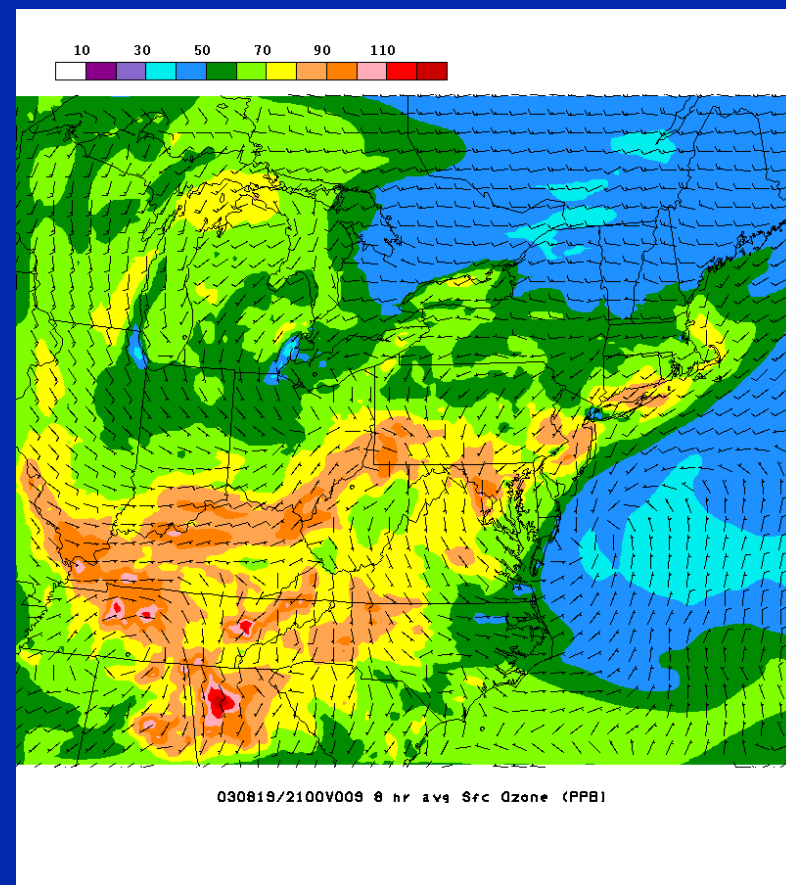
MODIS Aerosol Optical Depth 48-hour Air Parcel Forecast Trajectories



<http://idea-aqi.larc.nasa.gov>

Products Under Development – Photochemical Models (1 of 2)

- NOAA
 - Hourly 8-hr ozone forecasts using Eta-12 data
 - Only for eastern United States
- Link
<http://wwwt.emc.ncep.noaa.gov/mmb/aq/>
- Comparison to observations
<http://www.airnowdata.org/noaa/index.cfm>
- Post-processed images (from Bill Ryan)
http://www.nws.noaa.gov/ost/air_quality/index.htm



<http://wwwt.emc.ncep.noaa.gov/mmb/aq/>

Products Under Development – Photochemical Models (2 of 2)

Other models

- CHRONOS
 - Forecast ozone plots for North America
 - Link – http://www.msc-smc.ec.gc.ca/aq_smog/chronos_e.cfm
- MAQSIP
 - Forecast ozone plots for Texas (publicly available) and other states (private access)
 - <http://www.baronams.com/products/maqsip/>
- AIRPACT
 - Forecast pollutant plots for the Puget Sound region
 - <http://www.airpact.wsu.edu/>

Summary

- Internet products are the fuel that keeps the forecast engine running!
- There are many sources for each type of product – find the one you like
- Consistently focus on the same key products
- Use other products when the time or situation warrants